PERSONAL COMPUTER NEWS

EVERY THURSDAY

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THE COMPLETE COMPUTING WEEKLY

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REGULARS

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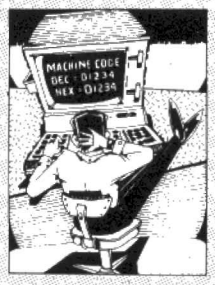
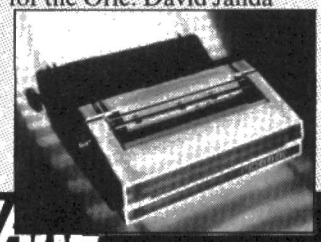
PCN PRO-TEST: SOFTWARE



Walter Knight continues his look at machine code on the Newbrain with a package to take the tedium out of low-level coding.

PCN PRO-TEST: PERIPHERALS



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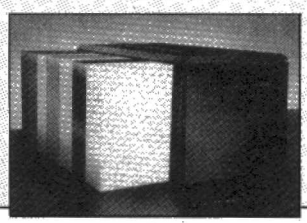

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Microdrive here

The long-awaited Sinclair Microdrives are set to be unveiled at noon today, despite reports that pre-production models of the drives were plagued with problems.

A Sinclair spokesman has declined to comment on any potential problems, but according to a *PCN* source who has used pre-production versions of the Microdrive:

- There are still problems with the RS232 interface on the Microdrive expansion module;
- The Spectrum's power supply may not be powerful enough to run more than one Microdrive;
- The £40 Microdrives have no random access; only limited serial access — so that files are stored on a tape loop, and must be designated as INPUT or OUTPUT files;
- The Microdrive manual doesn't specify how many files a Microdrive can hold — only that it's 100K per drive;
- Microdrives and the proposed Spectrum networking system both use up a chunk of the Spectrum's memory and some existing programs might not run without modification;
- The £30 interface module needed to run the Microdrive comes equipped with a second operating system: the existing O/S won't support Microdrive commands.

But the source added that in terms of access the Microdrives live up fully to what Sinclair has always claimed. The drives apparently can access data in 3.5 seconds and handle storage of both Basic and machine code programs.

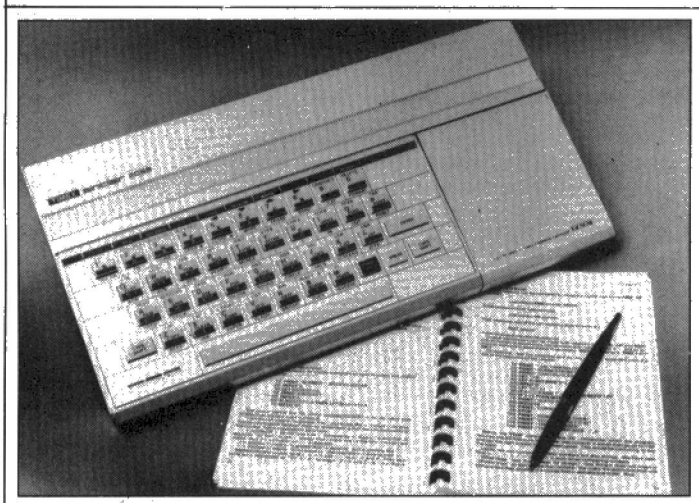
Today's launch will show what success Sinclair has had in sorting out the problems. Aside from the trouble with the RS232, which is apparently a recently discovered problem, the power supply difficulty could be solved by adding a separate power supply for the Microdrive expansion module.

Sord cuts

As the home computer price war hots up, a Japanese contender has hit back with price cuts on its own — the Sord M5.

With £40 knocked off its price you can now pick up the M5 for £149.95. The machine will be selling at the same price as Vic 20, Atari 400 and TI99/4A. And although the M5's memory seems small compared to other micros it offers some good facilities (*PCN Pro-Test, Issue 12*).

Users who bought an M5 at its original price of £189.95 will also benefit from the price reduction. Go back to the shop with some proof of purchase and you'll get a free Basic G language package worth £35.



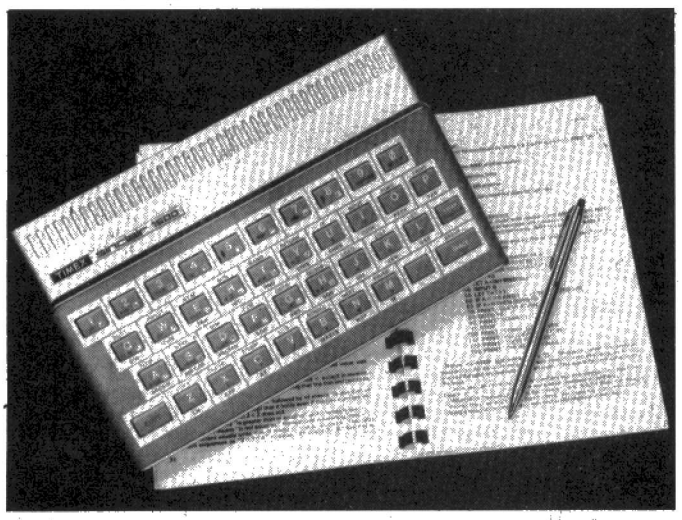
US Sinclairs unveiled

Timex has announced details of the new American-look Sinclairs. The cooly received American ZX81 (the TS1000) will be upgraded to the Timex TS1500. The ZX Spectrum will make its long overdue debut as the Timex TS2000.

The TS2000 has a number of changes from the British version. Obvious additions are a full size spacebar, cartridge socket and joystick ports. Inside, an additional 8K ROM provides a handful of extras for Basic, hopefully without ruining compatibility with existing software. Prices will be $150 for the 16K RAM version and $200 for the 48K model.

The 1500 is a ZX81 in Spectrum's clothing. It has a Spectrum style keyboard and a standard 16K RAM, upgradable to 32K. Cartridge software is planned and the price will be around $80.

The only thing left unsaid is the availability date. They will probably hit American stores in August or September.



Acornsoft goes multilingual

Multi-lingual BBC buffs can stride out as software developers. A fistful of new Acornsoft languages have finally been released.

And Acornsoft is promising an even richer range of lanugages for the National Semiconductor 16032 16-bit add-on processor when it comes out later this year.

BCPL is freshly out of Acornsoft, along with the long-awaited textbooks to go with the recent Lisp and Forth launches. Yet to come are Fortran, two versions of Pascal, Comal, Prolog, two versions of Logo, and one or two of the more esoteric languages such as ML/1 and Cesil.

Jeremy Bennett, who currently heads the Acornsoft language division, said that the Nat Semi 16032 will be accompanied by as many as 20 different languages.

'A BBC system with the second processor and a hard disk will be more powerful in terms of sheer processing power than a DEC VAX 750', said Mr Bennett. 'So with that kind of throughput, people will expect to be able to use the languages they have become accustomed to and prefer.'

The new BCPL, which is for the existing 6502 processor, is a systems programming language which Acornsoft is pitching chiefly at commercial and systems software developers.

It comes on ROM only, and sells for £99.95 as a complete package of ROM chip, compiler on disk, screen editor, assembler and various tools and utilities. The package also includes the user guide, which *is* ready in time for the language's launch. The compiler was written by Richards Computer Products.

Mr Bennett said that Acornsoft is using the BCPL to develop its Fortran compiler for the 6502, which should be ready by the end of the year. Before then, a cassette or disk-based version of Pascal S is due — Niklaus Wirth's teaching subset of the language.

Marathon plan

A row of perspiring micros will be trotting round endless loops for seven days in a marathon at London's World Trade Centre. The aim is to find the most reliable 16-bit micro of them all.

PCN will be there to referee the contest, the London Computer Marathon, which has been organised by Micro Networks — the company that distributes the Samurai S16.

The Samurai will be entering the contest, of course, as will 16-bit heavyweights from the stables of Olivetti, Logica, Sage, Tandy, Wang, Triumph Adler, and Comart. But IBM and ACT Sirius have decided not to give their official blessing.

Richard King, *PCN*'s features editor, will be keeping a close eye on the contestants in case of foul play and says that micros that stop running for any reason during the seven days will get a black mark on their score card.

The starting gun will be fired at midday, August 10.

The micros will be performing a fairly simple, repetitious task continuously for a week such as sorting and re-sorting a large file. They'll be scrutinised not only for the number of breakdowns, but also for the number of times the program is completed. Worn-out disks caused by excessive head pressure and buckled disks because of overheated disk drives are two possible causes of breakdowns during the contest. Particularly if there's still a heatwave!

Postal protection

By Geof Wheelwright

The Computer Trades Association is developing a plan to protect consumers against mail-order software houses that don't deliver the goods.

Association general secretary Nigel Backhurst said he would like to see all software houses take out bonds with insurance companies to ensure that suppliers meet their orders within 56 days or return the customers' money. And his association has commissioned a feasibility study from a group of insurance brokers in the hopes of launching the bonding scheme this autumn.

'We have over 100 complaints on file — and I suspect that's the tip of the iceberg,' said Mr Backhurst. 'And right now there's no way we can deal with it.'

He cited the extreme example of one schoolboy who recently took in £10,000 worth of mail orders for his cottage software business and then simply didn't fulfill the orders. And because the boy is under age, he can't be prosecuted and there is currently no way for customers to get their money back.

Mr Backhurst said that under his proposed bonding scheme, all mail order software houses would have to put up a certain amount of money as an insurance bond against their ability to fulfill orders — but added that the price could be as little as £50 for small operations.

And he has started polling computer magazines in the hope of getting agreements that prevent non-bonded mail order houses from advertising. Does he think this will prove unfair to small mail-order operations?

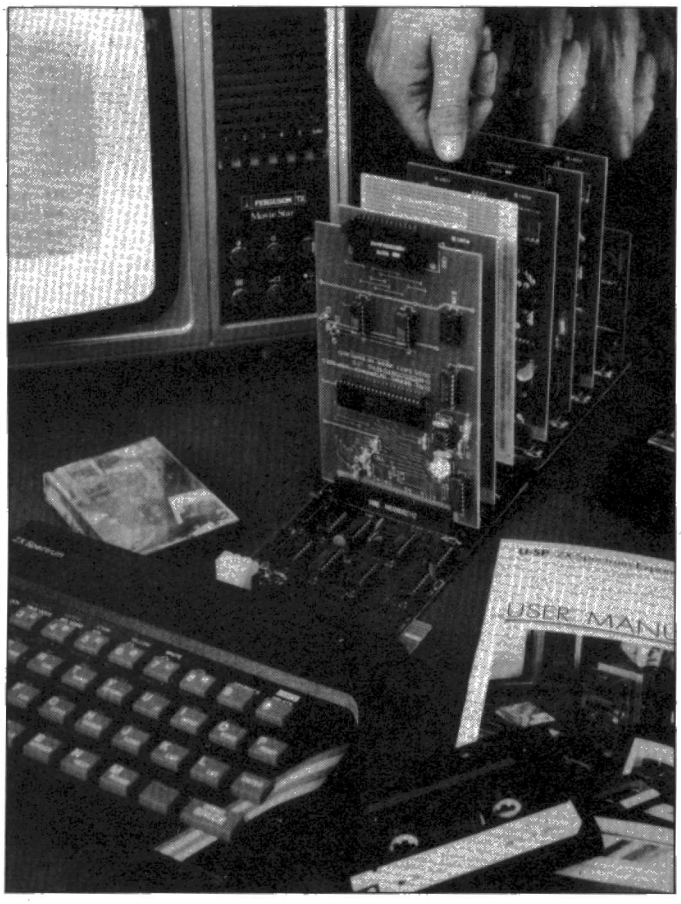
'If they can't afford to be bonded, then they shouldn't be in the mail order field,' he said.

The bonding operation would have to be run independently of all trade associations — including the CTA — although he suggested that many participants would probably be members of a trade association anyway.

Mr Backhurst hopes to have the report from his insurance brokers by September. 'At the moment, it's very much an exploratory idea. Towards the end of September we'll try and get a conference together of the leading mail order houses and the major magazines.'

Mr Backhurst also said he'd like to see mail order computer merchants bonded so that when people send off deposits for computers they're supposed to receive in the mail, those deposits would also be guaranteed if goods are not received within 56 days. He suggested 56 days as the waiting period because it gives the supplier twice the usual time to meet the order.

He suggested that part of the recent rise in mail order problems can be attributed to the number of young entrepreneurs entering the market with little experience.



Super expansion system for the Spectrum

U-Micros, prolific producer of Apple cards, has moved into the Spectrum add-on business. USP is an expansion system, based on a four-slot motherboard, to let you plug all sorts of gubbins into your Spectrum.

First offerings include a hobby/prototyping board and an additional three-slot expansion board. There's a dual serial port for £34.50 with software providing LPRINT, LLIST and a dumb terminal ability. USP I/O (£29.90) is a general purpose parallel port. An add-on kit (USP-CENT) provides a cable and software to let you use this to drive Centronics printers.

USP may not be as neat as Basicare's stacking rival but U-Micros (tel: 0925 54117) has gone a long way to giving the Spectrum an Apple-like growth path. So expect a lot of goodies in the pipeline.

Future prediction

Two versions of the Future FX30 computer plus a tape backup will be launched in September at the European Computer Trade Forum, Birmingham.

The FX30 Slimline, at a starting price of £3,350, has 5 or 10 megabytes of storage and a 'slimline' Winchester disk. Concurrent CP/M will be available at extra cost.

The standard FX30 will give 50 Mb of storage and has a 20 Mb tape backup. Buying both will cost £4,772.50, and they should be available in September.

But you won't have to wait till then for an FX20, which should be in stock at 65 Future computer dealers now.

Each FX20 will be sold with an IMPS (Interactive Modelling and Planning System) financial planning and spreadsheet package worth £322, plus Spellbinder, the word processor.

Newbrain printer link plugs a loophole

In an effort to fill up the cracks in the Newbrain edifice, such as non-delivery of the 'official' printer, Kuma Computers has launched a small utility to allow several common printers to act as substitute.

N-Dump is a machine code program which allows you to dump out the graphics image on the screen, producing a hard-copy version on the printer.

It obeys the same commands as the graphics screen, and allows magnification of either or both axes. The range of printers catered for includes the Shinwa CP-80 and Epson's MX and FX80.

The routine has a few limitations, however . . . It can only be used from Basic, since it follows the CALL DUMP, NN, NN, NN: format, which works in conjunction with the program-pointer.

Another restriction is that the routine is not relocatable.

N-Dump costs £16.70 from Kuma Computers on Maidenhead (0628) 71778.

Beeb on top

For the first time in three months the Sinclair Spectrum has been knocked off its perch as Britain's top-selling micro.

In the latest *PCN* Charts the Spectrum loses its place to the BBC Model B. In the middle of a fierce price war the BBC machine, which costs a mere £300 more than a 16K Spectrum, has proved to be the most popular machine in the country in mid-July.

According to *PCN*'s researcher MRIB, Acorn's distribution is largely responsible for its pushing Sinclair's into second place. 'BBC distribution is very good,' said an MRIB spokesman, 'it has been as steady as ever over the past few weeks. Sinclair had a very good early summer as far as sales are concerned and a lot of shops may be re-ordering, and be temporarily out of stock.'

The spokesman also suggested that Sinclair's promotional push following its price cuts may have run out of steam, but he predicted that the Spectrum would be back on top within weeks. 'The charts this week are based on very close figures indeed,' he said.

VIEW FROM JAPAN

IBM goes Japanning for gold

By Serge Powell

The Japanese react with unfeigned bafflement to the suggestion that their purpose in life is to overwhelm foreign markets and to undermine foreign industry. They just don't relate to the image Westerners have of them — an army of ants stripping the local vegetation and putting Hondas and Sanyos in its place.

This image is particularly strong in the US, where Japan Inc is regarded with something that can only be described as paranoia in the automobile industry and the computer business. So it is particularly interesting to see the US fighting back, and on Japanese home ground.

In the vanguard of the US counter-attack is none other than IBM, which is by no means the dominant force in Japan that it is almost everywhere else. But its guerilla activity is being abetted by another US company, Computerland, and the link between the two is purely Japanese.

East has met West in this relationship. A sophisticated retail system and sophisticated personal computer have been combined with an attention to local conditions that is quite outstanding.

The product is not the IBM PC.

The new IBM system is called the 5550. It was first announced here earlier this year but now as it starts to appear it promises to make quite an impact.

It is capable of handling the complexity of written Japanese as well as, if not better than, many of the domestic models. Where basic literacy is concerned this means having a character set that includes two alphabets of 52 characters each and another 2,000 ideograms, all from a modified typewriter keyboard.

For business applications, which is where IBM would hope to make its biggest splash, between 6,000 and 8,000 characters of varying complexity are necessary and the 5550 takes them in its stride, as indeed do most of the native systems. It is in the other features that it scores.

Built around an Intel 8086 it has 256K of RAM and you can hang up to three 640K floppy drives or an 8.1Mb hard disk with diskette back-up. Its keyboard has 61 data keys and 63 function keys. Output features include eight colours for text and four for graphics. The software available on the machine includes Japanese language word processing, a spreadsheet, and other business applications.

As it stands the machine would be a formidable competitor for front-runner NEC and for the group (including Fujitsu and Hitachi) that contends for second place. But the key to the 5550's success, and the message to other manufacturers looking for a niche in the Japanese market, lies in the involvement of Japanese firms in its development and construction.

It is no secret that IBM has worked very closely with Matsushita and Oki in the production of the unit, as it did in the production of the PC. The difference that this tie-up makes to the 5550's reputation is all important; it combines IBM's shrewdness with Japanese quality control.

So where does Computerland come in? The IBM 5550's distribution in Japan is being orchestrated by a medium-sized trading company, Kane-Matsugosho, and this same company paved the way for Computerland's entry into the country. The arrival of this US retailing giant was long overdue, because one of the saddest features of the Japanese micro business has been the state of retailing.

Even in outlets for computers and related products the staff tend to lack a certain savvy. For Computerland, which has built a worldwide reputation on the extent of its service and the knowledgeability of its staff, the situation is ripe for it to move in.

In seven months it has opened 15 stores and within two years or so it expects to have 250. For all its US roots, Computerland is wearing a Japanese face here. Its partner, Kane, has all the right connections in Government and banking circles, and individuals in business are likely to follow.

ACT mails via Apricot

Sirius owners will be the first to get their hands on Micromail, an electronic mail service launched by ACT last week for use on the Sirius, Apricot, and soon the IBM PC.

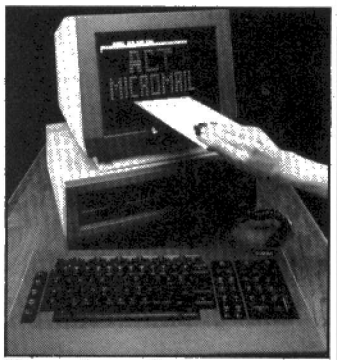
Apricot isn't due to reach dealers until October, by which time the system should be available for the IBM. ACT says the service will deliver letters for less than the cost of a second class stamp.

Based on British Telecom's Telecom Gold network, Micromail costs £316.25 for a small modem card which plugs inside the computer, disk-based software which communicates over the telephone lines, and the annual subscription.

Micromail software on its own for use with other modems/acoustic couplers is £109.25, and ACT says that the system takes only one hour to get used to.

Tony Bryan, managing director of ACT, said: 'We don't intend to take over the telex market — we are aiming at small business users. Security takes the form of a personal password, we register you when you buy the package, and you can transmit an A4 letter of 400 words in less than one minute at a peak rate price of 17p long distance and 15p within London.'

The cheap rate — before 8am and after 7pm — is 3.5p a minute.



Micromail — a pillar box on your desk

Information storage costs 20p per unit (=2000 characters) per month, and means you can hold over correspondence for transmission.

The system is claimed to deliver letters to the recipient's mailbox in seconds, and you can request an immediate reply to urgent mail. An optional radio pager can warn of incoming messages.

Micromail can produce 500 automatic copies of each letter and provides an electronic diary as well as a noticeboard for important messages. It amends text on the spot and has send-read-scan commands as well as a spelling check.

Mr Bryan says that ACT dealers should receive the package in the next two weeks.

Voltmace moves to joystick set

Some of the hand spans that keyboard-controlled games demand of you would tax a concert pianist. But there are moves afoot to translate keyboard functions in games programs to joystick control.

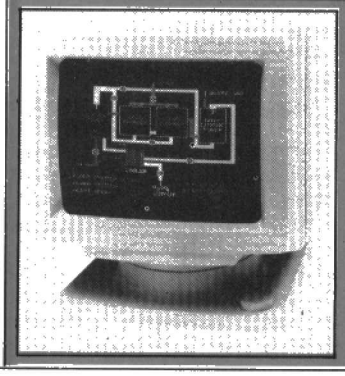
The latest supplier to take this route is Voltmace, maker of the Delta 14 handsets for the BBC micro. In future all deliveries of the handsets will come with a listing that will transfer the functions of the keyboard to the joystick or keypad of the Delta 14. The idea is that those programs that weren't written for joystick control can then be run with the Delta units.

By way of an example, Acorn's Meteors uses caps lock for 'rotate left' and control for 'rotate right', 'fire' is return, 'thrust' is the shift key, and a careless contact with the space bar puts you in 'hyperspace'. After running Voltmace's program the joystick and three function buttons can take over from the keyboard.

The software handles a total of 16 keyboard functions, and it will work with any program that uses Inkey or Osbyte signals to detect key depressions.

The handsets themselves cost £10.95, and an adaptor box adds £13.95 to this.

Voltmace is on Baldock (0462) 894410.



SABRE RATTLING — What is claimed to be a British advance in colour display technology makes its commercial debut in the Sabre and Rapier 'super-high contrast' units from Coventry-based Cotron Electronics. The monitors incorporate a faceplate that features rare earth chemicals and colourants which Cotron says cut out the phosphor emissions that affect conventional monitors. Contrast is enchanced by 35 per cent, says Cotron. The medium resolution Sabre costs £399, the high resolution Rapier £550. Cotron is on Coventry (0203) 21247.

Intel boosts Xenix

In a move which brings the affordable super-computer a step nearer, Intel has announced a version of the Xenix operating system for its iAPX 286 series of chips.

The company had publicly thrown its weight behind the Xenix operating system last year when it said it was planning an operating system on a chip, the system in question being Unix.

It now transpires that it has chosen to develop Xenix 286 in conjunction with Microsoft's version, and in the process has enhanced the design to make the system attractive to commercial users.

These extras include functions to recover data which may have been damaged by a loss of power, and operator-security in the form of record and file locking, which should prevent unauthorised people tampering with restricted data.

In a further move designed to attract commercial systems houses and OEM companies, it has included driver programs for five controller boards, which by providing 'plug-up and go' I/O support should make development times much shorter, thus reducing costs.

Xenix 286 is a derivative of Bell Labs' Version 7 Unix, designed to run on microprocessors, and supporting multi-tasking with multiple users. It is compatible with earlier versions of Microsoft's Xenix which run on the 8086 processor, so software already developed will still be useable, with the new system.

However, from what the company says, it would seem well worth converting to the newer system. It is said to run from three to five times faster, which with several users will make a big difference in productivity.

Naturally, an iAPX 286 running Xenix 286 'produces . . . one of the fastest commercial microcomputer operating systems available'. With the addition of an 80287 maths processor and memory management Intel could well be right.

Atari brings micro summer camps into the cities

Most computer camps aim to give you micro training combined with outdoor activities and fresh air. But 40 one-week camps, organised by local groups, will put the computer camp idea into inner city areas this summer.

Children between nine and 16 years will be able to join in the activities in most UK cities, and the charges will be nominal in most cases.

Atari is donating a total of more than 100 Atari 800 systems for the London camps, which will be held in Kentish Town, Greenwich, Edmonton, Westminster, Haringey, Leytonstone, and the docklands.

The camps aren't residential, but most will provide a lunch every day. The training will cover programming techniques and it will aim to give some insight into how computers can help you in education and employment.

The original idea for the camps came from the national charity Inter-Action Trust, which is on (01) 267 9421.

Beeb talks

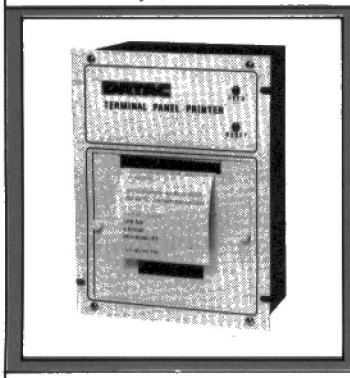
The BBC Micro's tendency to be seen but not heard is changing rapidly as another speech synthesiser is launched (*PCN*, issue 20).

Selling at £37 plus VAT, Smartmouth is a small unit that sits alongside the BBC. It has its own loudspeaker, as well as an auxiliary audio output socket.

The unit doesn't need any soldering and connects to the user port. And due to its low memory requirements (using four to eight bytes per word), it's now possible to put speech into existing programs without using up massive amounts of memory.

Included with the speech synthesiser are demonstration and development programs on cassette and full software instructions. The instructions supplied explain how to string together individual speech sounds (allophones) to produce your words. As there are only 64 allophones to choose from words can be assembled at speed.

Smartmouth comes with one year's full warranty and is available from Technomatic Ltd, (01) 452 1500.



WALLFLOWER — Fancy an upside-down two colour printer you can screw into the wall? You do? Well how about this nifty little number from Datac. It's property titled the 502 panel-mounted printer and costs £165. It prints 40 characters per line on 70mm wide paper in red and black at little over a line a second. You can link it to a micro through a serial or parallel interface. Datac is on 061-941 2361.

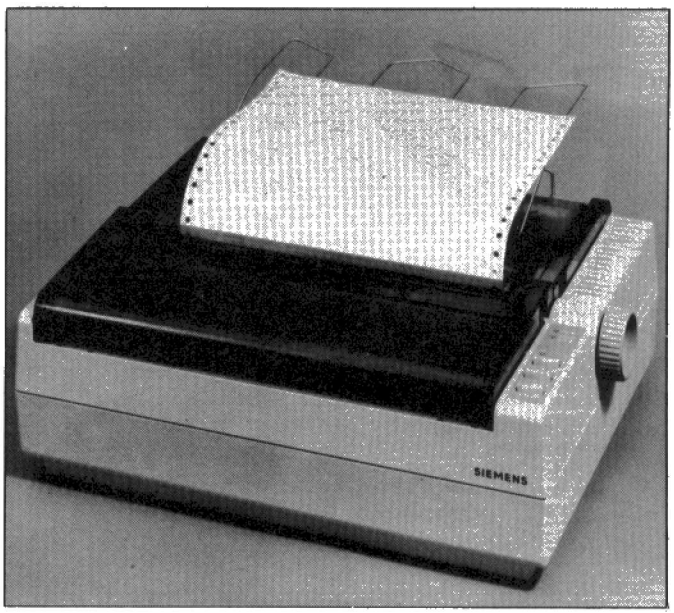
Riva jets ink

The buzzsaw noise of a dot matrix printer isn't to anybody's taste but technology can be relied upon to come up with a silent alternative.

Ink-jet dot matrix devices are in general faster, quieter, more precise and more expensive, with the added drawback that they can't produce multiple copies. But Riva Terminals is backing its new PT88i from Siemens with an interesting statistic: the West German manufacturer has found that only 60 per cent of micro users need multiple copies.

If you find yourself in this 60 per cent, the PT88i could be worth looking at. It has bi-directional printing at 150 cps, and it operates via serial or parallel interfaces on most popular micros. Riva expects it to catch the eye principally of people running small businesses.

The printer costs £595 and Riva Terminals is on Woking (04862) 71001.



Apocalypse now aids Aquarius

The imminent launch of Mattel's Aquarius (*PCN*, issue 20) will have a number of software releases trailing in its wake.

Apocalypse Software promises to have arcade games and semi-educational programs ready for the machine's launch. The first releases, which Apocalypse says will include such old favourites as Breakout, will be for the unexpanded version of the system.

But Apocalypse plans to move beyond cassette-based games into languages.

Its first products for the Aquarius, due in three weeks' time, will cost between £8 and £10.

Everyone wins

Everyone came away as a winner at the Lasky's/Daily Express Competition last week, when eight schools shared £20,000 worth of micro equipment.

The schools received four first prizes of £3,500 and four second prizes of £1,500 of computing equipment to be selected from Lasky's stores.

In the first heat of the competition schools were asked to send in essays and illustrations describing the home of the future. Then at the showdown at the Westmoreland Hotel, in London, pupils representing the schools were asked to design and decorate their idea of a family home in the year 2000 using Atari 800 computers with A810 disk drive, a Pointmaster joystick and Micropainter software.

H-P source for graphic design

Technical jobs that need the power of a Motorola 6800 can now be tackled by a desk-top system from Hewlett-Packard.

The machine is called the H-P Model 16. Hewlett-Packard distributors are selling it in packaged form with various graphics and computer-aided design tools. The basic system has 540K of memory that can grow to 4.6Mb with an optional card cage; you can add 3.5in Sony microfloppies or Winchester disks that hold up to 10Mb.

The peripherals offered with the Model 16 reflect the expected kind of uses — graphics plotters, tablets, and printers. Distributor Crellon Microsystems is also offering software for AC circuit analysis, digital filter design, numerical analysis, and other scientific jobs.

The unit's graphics output has 300 by 400 pixels and an optional 512 by 512 display. Standard languages are HP Basic, Pascal, Assembler, Fortran 77 and Multi-Forth.

A system with 512K, graphics, Basic 2.0 and twin 3½in floppies will set you back about £6,000 once VAT is taken into account.

Teach yourself Applesoft with new US packages

Software hardbacks — programming guides for Apple users.

A couple of new Applesoft Basic programming aids have made their way from the US to British shores.

How to Program in Applesoft Basic takes you from basic programming up to advanced high resolution graphics in 12 self-paced lessons. The Programmer's Workshop for Applesoft Basic gives a Basic programmer a chance to have a bash at structured programming.

Beginners, the company says, will get the best out of the package from its step-by-step introduction and the library of useful subroutines which the Framework program provides. Experienced users will find the structured approach to Basic will help them design and write better-organised code.

Both packages cost £39.20 and are available from Pete and Pam Computers, 0706-227011.

PORTABILITY — You've seen libraries on wheels, now micros have taken to the road. Hal Computers and Bedfordshire Education Authority's Technology Trailblazers are embarking on a joint venture to provide mobile education for schools throughout the country. Equipped with BBC and Apple, the unit will travel the country promoting the concept of mobile teaching — bringing high technology to schools which might not have access to it.

HX20 disk devised

Epson has always presented its HX20 as a business machine but it has taken an outsider to supply the missing ingredient, disk drives.

Maidenhead systems house Kuma has released the drives. It has previously specialised in software for the Epson machine and has extended this to produce an operating system to go with them.

For £572.70 you get the dual drives, disk operating system and Basic, giving you 655K of formatted storage.

Epson is currently putting the finishing touches to its own disks — software is being prepared before an official launch. According to an Epson spokeswoman the devices are not yet available in sufficient quantity to go on sale in the UK.

Kuma has also produced the long awaited Deskmaster 5 — also for the Epson (*PCN, issue 9*). The last of the Deskmaster series to materialise is described by Kuma as 'an enhanced communications package' which provides editing facilities. For example, this £45.45 package enables you to prepare text before you go on-line to an electronic mailbox.

And for anyone needing a word processor, the company has produced a low cost package based on the Sharp MZ80A. For £862.50 you get an MZ80A micro, Shinwa printer, interface card, paper and cassettes.

Kuma is on (0628) 71778.

Mouse comes out of traps

A mouse from Televideo should be on the loose this autumn, priced at £103.45 and specifically for use on the company's 8 and 16-bit business computer systems.

Televideo spokesman Sam White said: 'The mouse will enable you to alter display data on the screen without using keyboard commands, and will be good for word and graphics processing, spreadsheets etc.'

The race to deliver a working mouse is moving into the home straight. Microsoft's £140 mouse isn't available as yet, and Texas Instruments is still working on its own version.

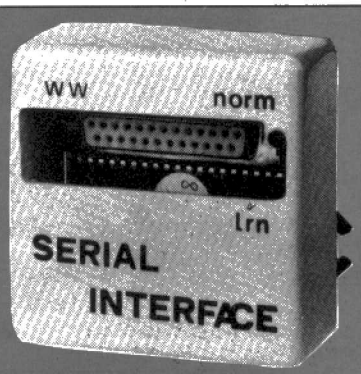
Peach packs pass test

Zenith Data Systems has made sure that business users will be able to buy tested software to run on their Z100 micros by putting Peachtree packages on to the system.

The system implemented goes under the collective title of Peach 5000. It runs under MSDOS (Z-DOS in Zenith parlance) and includes a word processor, financial planner, and database.

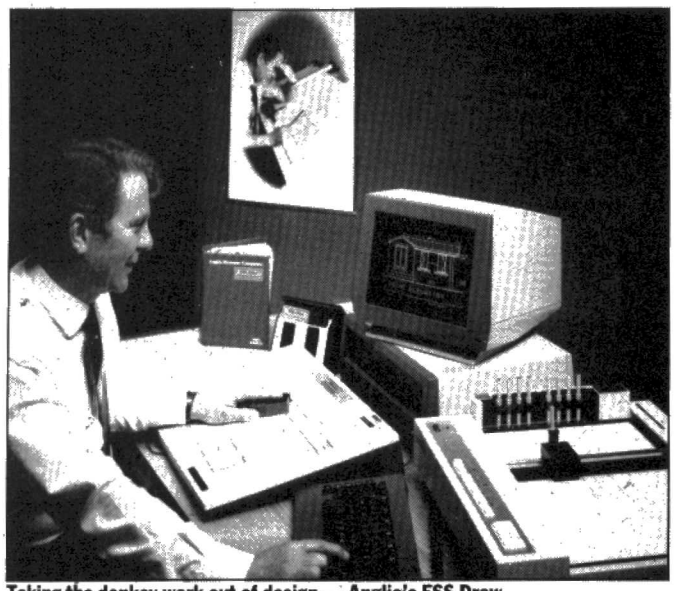
Zenith dealers will be carrying the Peach 5000 series and it will cost you £392. Sweetening the pill are ten floppy disks and a utility program to convert Wordstar files.

Zenith Data Systems is on Gloucester (0452) 29451.



ADEPT ADAPTOR — Mikrocomputertechnik has developed a device which may be of interest users with RS232 interfaced computers and Centronics printers. The company claims it will connect almost any Centronics-like printer to computers with RS232 output. It further claims that any computer user can install the device within seconds without attention to dip switches, soldering irons or jumpers. The interface is said to detect the baud rate, number of data bits, number of stop bits, and parity and even to adapt itself to various pin-outs. The Self-Teaching Serial Interface is available from Mikrocomputertechnik, Winchenbachstr, 3a, D-5600 Wuppertal 2, West Germany at $125 per unit.

Drawing on the Sirius



Taking the donkey work out of design — Anglia's ESS Draw.

Designers and draughtsmen can ditch conventional drawing board methods and pick up a computer-aided design system, ESS Draw, from Anglia Business Computers.

The system runs on a 256K Sirius and costs £800. It is aimed at applications that include architectural drawings, kitchen design, mechanical drawings, schematics, flow diagrams and so on.

ESS Draw allows the user to create drawings of any size or scale. Drawings can be stored on disk and can be output on a plotter or printer at any point during the drawing process.

Text of any size can be inserted on the drawings at any position and a window and zoom facility allows working on the drawing at any level of detail. Drawn objects can be moved, copied, modified, deleted, rotated and scaled.

The package is written in a mixture of Fortran and 8088 Assembler and runs under the MSDOS operating system. In addition, the software is command driven with two key commands.

Two other new packages the creatively minded can look at are ESS Plot and ESS PCB. Both packages are written in the same languages and run under the same operating system as ESS Draw.

ESS PCB costs £1,120 and is a self contained system produced as an aid to the design and manufacture of printed circuit board artwork.

ESS Plot is a graphics package designed for both the business and scientific user. Selling at £340, it can be used on a stand alone basis or data can be generated from other programs in standard ASCII format.

Contact Anglia Business Computers, 0223 315580.

Continental confidence

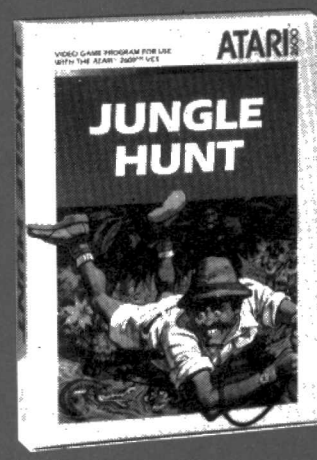
Is there something about the way that Continentals make floppy disks? The French manufacturer Rhone-Poulenc has now followed the lead of BASF, from West Germany, in offering a lifetime guarantee on its floppies.

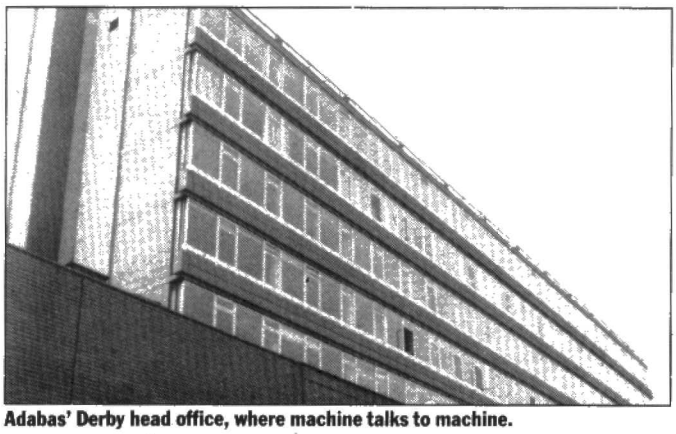
The deal offered by Rhone-Poulenc means that any customer who finds a fault caused either by the materials or the workmanship on a Flexette floppy disk will be entitled to have it replaced free, regardless of when it was bought.

Rhone-Poulenc produces 8in and 5¼in floppies, single and double sided and single or double density, in the Flexette range. The disks are polyester based and specially coated to give a uniform surface.

Rhone-Poulenc can be contacted in the UK on (0582) 605551.

ATARI SAFARI — Fed up with zapping the Klingons? Then try this latest game from Atari. Swing through the jungle. Swim across the crocodile-infested river. Avoid the falling boulders. Jump over the poisoned spears into the cannibal camp. And rescue the beautiful maiden. The cartridge costs £24.99 and is available from your nearest Atari dealer.





Adabas' Derby head office, where machine talks to machine.

Natural summit for IBM PC

The mainframe software company Adabas is aiming to take some of the sting out of data processing for the personal computer user with a product to link the IBM PC to an IBM mainframe.

It isn't the first to try this tack — Cullinane and Cincom have also gone down the same road. Adabas claims that the combination of its database management system and its Natural programming language will be what makes the difference.

Natural is a language of the type known as 'fourth generation'. It is intended for non-experts and is supposed to turn them into programmers. By putting it at the disposal of those of you with an IBM PC Adabas reckons to give you the resources of the mainframe network without the headaches of large-scale data administration or the overheads of a programming department.

As a tool to increase the productivity of executives with PCs on their desks you might look askance at this. But as another string to the PC's bow in general applications it could be worth looking at.

Adabas is on (0332) 372535.

Beeb fivesome

New out from software house Quicksilva are five games for the Spectrum and an Art/Design program for the BBC Model B.

Beeb-Art at £14.95 uses the BBC's graphics capability and acts as a sister program to the company's Music Processor.

Using Beeb-Art, you can put lines or shapes on to the screen using a joystick or cursor keys. You can use all 16 colours in mode 2 and can save the picture on cassette for reloading later.

3D Strategy for the Spectrum is based on 3D noughts and crosses. Like all the new Spectrum programs from Quicksilva, it costs £6.95.

Aquaplane is an arcade game for water-borne adventurers. Xadom, another arcade game, involves avoiding Wattdogs, Vampbats and Antimattoids as well as fighting with Vibe Vipers, Num Skulls and Cybots. Velnor's Lair is a dungeons and dragons style adventure game. Smugglers Cove involves looking for the inevitable treasure.

Director Mark Eyles says these programs can be bought in all main outlets such as Smiths, Boots and Lasky's as well as small retail shops. In the future, some record shops should stock these programs, now that CBS has become the exclusive manufacturer and distributor of Quicksilva's range in the UK.

PCN Charts

You've followed the micro charts — now here's the games top 30 compiled from both independent and multiple sources across the nation. They reflect what's happening in high streets in the two weeks up to July 21 and, like the micro charts, do not take account of mail order sales. We'll be keeping them up to date, showing new positions every two weeks, so watch for the changing status of your favourite games.

The micro charts this week show the number of machines sold in the

GAMES

Top Thirty

			GAME TITLE	PUBLISHER	MACHINE	PRICE
▲	1	(2)	Jet-Pac	Ultimate	Spectrum	£5.50
▲	2	(8)	Penetrator	Melbourne	Spectrum	£6.95
▲	3	(6)	Gridrunner	Llamasoft	Vic 20	£8.50
▼	4	(3)	Trader	Quicksilva	Spectrum	£9.95
▲	5	(7)	Transylvanian Tower	Shepherd	Spectrum	£6.50
▲	6	(11)	Ah Diddums	Imagine	Spectrum	£5.50
▼	7	(4)	The King	Microdeal	Dragon 32	£8.00
▼	8	(5)	Arcadia	Imagine	Spectrum	£5.50
▲	9	(13)	Killer Gorilla	Micropower	BBC	£7.99
▲	10	(—)	SS Enterprise	Silversoft	Spectrum	£6.00
▼	11	(1)	The Hobbit	Melbourne	Spectrum	£14.95
▲	12	(14)	Flight Simulation	Psion	Spectrum	£5.95
▲	13	(20)	Zaxxon	Datasoft	Atari	£29.90
▲	14	(18)	Black Hole	Quest	Spectrum	£6.00
▲	15	(21)	Timegate	Quicksilva	Spectrum	£6.95
▶	16	(16)	Moon Raider	Micropower	BBC	£7.99
▲	17	(—)	Matrix	Llamasoft	CBM64	£8.50
▼	18	(15)	Miner 2049er	BigFive	Atari	£29.95
▲	19	(—)	Planetoid	Acornsoft	BBC	£9.95
▲	20	(24)	Everest	Shepherd	Spectrum	£6.50
▲	21	(28)	Psst	Ultimate	Spectrum	£5.50
▲	22	(30)	Knot in 3D	New Generation	Spectrum	£5.50
▲	23	(26)	3D Combat Zone	Artic	Spectrum	£4.95
▲	24	(25)	Xenon 1	IJK	Oric	£5.50
▼	25	(10)	Frenzy	Quicksilva	Spectrum	£4.95
▼	26	(12)	Krazy Kong	Interceptor	Vic 20	£6.00
▼	27	(9)	Horace Goes Skiing	Psion	Spectrum	£5.95
▼	28	(17)	Panic	BugByte	Vic 20	£7.00
▲	29	(—)	Preppie	Atari	Atari	£21.00
▲	30	(—)	Pakacuda	Rabbit	CBM64	£5.99

PCN Charts

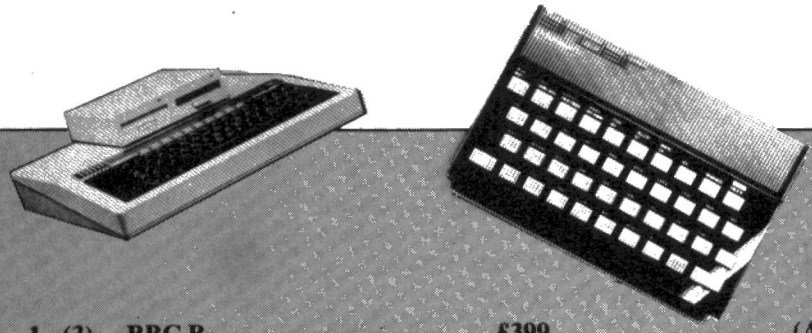
two-week period ending one week before publication date, so they tell the story in the high street between June 7 and July 21.

Neither mail order nor deposit-only orders are included and the prices quoted are for the no-frills models and include VAT. Information for the top-selling micros is culled from retailers and dealers throughout the country and, like the games, will be updated every alternate week. Watch the arrows to see how they're doing.

PCN Charts are compiled by MRIB (Computers), London, (01) 408 0250.

HARDWARE

Top Twenty up to £1,000



▲	1	(3)	BBC B	£399	(AC)
▼	2	(1)	Spectrum	£99	(SI)
▲	3	(4)	Vic 20	£150	(CO)
▼	4	(2)	Dragon 32	£175	(DR)
▶	5	(5)	Atari 800	£300	(AT)
▲	6	(9)	Commodore 64	£229	(CO)
▼	7	(6)	ZX81	£40	(SI)
▼	8	(7)	Oric 1	£99	(OR)
▼	9	(8)	Atari 400	£150	(AT)
▶	10	(10)	TI 99/4A	£150	(TI)
▲	11	(12)	Newbrain A	£228	(GR)
▼	12	(11)	Colour Genie	£168	(LO)
▶	13	(13)	Lynx 48	£225	(CA)
▲	14	(17)	Epson HX20	£472	(EP)
▲	15	(18)	Tandy Colour	£240	(TA)
▲	16	(19)	Sharp PC1500	£169	(SH)
▼	17	(15)	Apple IIe	£969	(AP)
▲	18	(—)	Jupiter Ace	£90	(JU)
▼	19	(14)	Sharp MZ80A	£549	(SH)
▲	20	(—)	Acorn Atom	£174	(AC)

Top Ten over £1,000

▶	1	(1)	Sirius 1	£2,754	(ACT)
▶	2	(2)	IBM PC	£2,392	(IBM)
▲	3	(10)	Commodore 8096	£1,374	(CO)
▲	4	(5)	DEC Rainbow	£2,714	(DEC)
▲	5	(6)	Osborne 1	£1,581	(OS)
▲	6	(7)	HP86A	£1,541	(HP)
▼	7	(4)	Apple III	£2,780	(AP)
▼	8	(3)	Olivetti M20	£2,754	(OL)
▼	9	(8)	Epson QX10	£1,700	(EP)
▲	10	(—)	Sanyo MBC 2000	£2,242	(SA)

AC — Acorn Computers. **ACT** — ACT Apple Computers. **AP** — Apple. **AT** — Atari International. **CA** — Camputers. **CGL** — Computer Games Ltd. **CO** — Commodore. **DEC** — Digital. **DR** — Dragon Data. **EP** — Epson. **GR** — Grundy Business. **HP** — Hewlett-Packard. **IBM** — IBM. **IC** — Icarus Computers. **JU** — Jupiter Cantab. **LO** — Lowe Electronics. **LL** — Lucas Logic. **OL** — Olivetti. **OR** — Oric. **OS** — Osborne Computers Corporation. **SA** — Sanyo. **SH** — Sharp. **SI** — Sinclair. **SO** — Sord. **TA** — Tandy. **TI** — Texas Instruments.

RANDOM ACCESS

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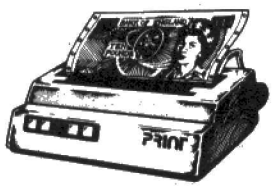
Justice for rough trade

As an owner of a Spectrum and a trading standards officer, I was very interested in Ralph Bancroft's article on insurance cover for micros (*PCN, issue 19*). One thing he fails to cover is the legal aspect, *ie* the Sale of Goods Act.

PCN £10 Star Letter



If the goods are of faulty manufacture and the fault was not readily discernible on purchase, or the buyer did not have an opportunity to examine the goods, or the goods are not fit for the purpose intended, then the purchaser is entitled to some redress, *ie* replacement, a repair or a refund (possibly minus something for use) and this right is against the retailer as well as the manufacturer, despite anything to the contrary in the guarantee.

Indeed, if the guarantee says anything to the contrary the seller and/or the manufacturer may be committing a criminal offence as per the Consumer Transactions (Restriction on Statements) Order.

In other words, if your micro fails and you can show it is due to faulty manufacture rather than abnormal use or abuse, then it is up to the retailer to do something about it.
I D Moseley
London E6.

A sprite old mess

Top marks for bad operating manuals must surely be given to Commodore.

Starting from scratch with a ZX81, it is unbelievably simple to learn how to write simple programs and to develop with a mixture of understanding and worked examples. The operator manual for the ZX81 is outstandingly good.

Wanting a larger capability I bought the Commodore 64, expecting it to be relatively easy to expand what I had already learned. The operating manual for the 64 is a disgrace, and for anything other than the simplest programs I still have to use the Sinclair.

For example, in a multiple choice menu the Sinclair sequence is easy:
100 input ×
110 GOSUB 1000 ×

This sequence does not work on the Commodore but what is worse is that there is no clue in the manual, how a choice of GOTO or GOSUB addresses can be handled.

Similarly, in the section on Sprite graphics, the crucial instruction "POKE 2042,13" is explained by the following paragraph: 'This instructs the computer to get the data for Sprite 2 from the 13th area of memory. You know from making your Sprite that it takes up 63 sections of memory. You may not have realised it, but those numbers you put across the top of your grid equal what is known as 3 bytes of the computer. In other words each collection of the following numbers, 128, 64, 32, 16, 8, 4, 2, 1 equals 1 byte of computer memory. Therefore with the 21 rows of your grid times the 3 bytes of each row, each Sprite takes up 63 bytes of memory.'

So, until I find a manual (or an expert) to explain the '13' there is no way I can use two different sprites.

It would also be interesting to know how to use the four 'special function' keys, but for all the reference to them in the manual, they might as well not be there at all.

My other grumble is Commodore's policy decision to make all models incompatible.

A friend has a Vic 20 but there is no way his software will run on my 64. Software — or even data disks — from a 64 will not download into a Pet, and even software and data for the second generation Pets (the 8032 type) cannot be used on the third generation Pets (the 700 series) so that any company wanting to increase on existing computerisation cannot introduce the newer computer, or accepts incompatible records.

Perhaps the ultimate absurdity is that software made to run on the 8032 will not use the extra memory of the 8096 even when it needs it and the memory is available, without a rewrite.

After the simplicity of Sir Clive's machines and the good operating manuals, the CBM manuals and incompatibilities are disastrous.

The sooner Sir Clive moves into the bigger arena and rescues us from this kind of shambles, the better I will be pleased.
Peter J Chadwick
Cobden Chadwick Ltd, Engineers, Oldham.
PS. Perhaps the ultimate absurdity: the best guide I have yet found to the Commodore 64 is the one written by SINCLAIR!!

Newbrain — food for thought

I felt it was time to write; being a Newbrain owner I have searched for programs everywhere!

Everybody, especially some Dragon owners, take the mickey for the lack of software. Well, now is the time to strike back.

Not only are there all the business programs and mail listing etc, but I have bought three adventures — Life Search, The Swamp and Leopard Lord — and even as I write more are being churned out.

I am in the closing stages of writing one of my own which has taken months to write and put together.

Nor are there only adventures but also all the action games you could wish for.

So, it's nuts to all the anti Newbrain owners.
Dave Holmes,
Aylesbury, Bucks.

Price cut consequences

There has been much speculation lately in many computer magazines about software prices. One view is that software producers could reduce their prices by reducing their profits.

It should, however, be obvious that the producers (naming no names) are rather fond of their profits and would probably take the reductions out on their improverished programmers (the hard-luck letter explaining why the n% royalties have suddenly dropped to £x).
Michael Robinson
Bramhall, Cheshire

Just what drives Clive?

I read with great interest your artist's impression of the Microdrive — I had no idea my Spectrum was going to be sitting on a lump of cheese like that!

On the other hand, I've heard so many views of what this long awaited kit is going to look like that I've quite stopped believing them.

I can imagine old Sir Clive trundling into the activity centre (is there one?) of Sinclair Research Inc in his electric three-wheeled car.

In the corner of the room a small machine is turning out thousands of letters: 'Dear . . . We apologise for the delay of your . . .' etc. The rest of the design team is grouped around a two-inch television pausing only to calculate a new, later, production deadline for the microdrive: LET NEW DEAD-LINE = OLD DEADLINE + INT (RND*4 MONTHS) + 1.

'OK chappies,' he calls, 'You'd better start thinking about this Microdrive thing. I see that *Personal Computer News* has got a rather good idea for the main format.'

Maybe, by the time you receive this, the Microdrive will be around — I doubt it somehow. If it is, I will probably have bought one, whatever the price, and since I am 'fortunate' (is that the right word?) enough to be on the list of first 1,000 orders for the Spectrum I might not have to wait more than the stated 28 days for it.

All the same, it has been many moons since the drive, revolutionary as it may be, was announced and I think that something should be done about the claims that certain companies make in this field.
James Reid
Maidenhead, Berks

Arise, Sir Clive, this is an ungloved challenge! But with today's planned launch, the Microdrive saga seems to be over, at least for some — Ed.

A word for minnow

I would like to let Spectru (Gameplay, issue 16 on Computer Scrabble for Spectrum) know that 'minnow' across the top will score 33. From his score he looks like he needs a bit of help. He probably managed to find a better word himself, but a little help from the sides never goes amiss.

Finding a better word is almost as satisfying as thrashing the Mico-Gen chess program at level 0 — my reasoning being that I never think more than one move ahead at chess, so why should a computer?

Anyway, I'm going back to designing my noughts and crosses program — unique in the field of computer games, because the program is designed so the computer loses. This program will be available for the 48K Spectrum (a 16K version may be available later if the program can be satisfactorily trimmed) at £14.

An intensive media advertising campaign will get underway several months before it's launched 'only next year'.

Simon Bass
Wigan, Lancashire

Any advances on minnow? — Ed.

Lease line of resistance?

Having examined for some little time the feasibility of a novel computer application, I was naturally interested in John King's comments on leasing (*PCN*, issues 17 and 18).

My experience is that while numbers of suppliers advertise the availability of credit facilities, HP or leasing, few are prepared to elaborate — at least to me! Some responses are distinctly frivolous, I hope.

One company, for instance, offered the Sirius 1 for £230 a month (VAT included). I took this to mean that if I really intended to take their advert literally then I should be made to pay for my temerity.

£13 a week, a rate widely advertised for another micro, turned out to be applicable to a seven-year (yes, seven-year) lease. I suppose that it is at least interesting to speculate as to how the present day micro will appear to the user in 1990!

Can it be that suppliers are really not at all interested in anything very far removed from cash on the barrel, despite the financial advantages of leasing etc to potential business customers?

Do they fear that leasing may tie them to supporting systems which five years hence may seem as useful as ENIAC appears today? In fact, is the response I have (not) been getting no more than the result of the old dilemma?

Rapid development=rapid obsolescence? If so, can one expect a bank or other financial institution to take a different view?

It did occur to me that I was perhaps being altogether too paranoid and that the poor response was due to some other cause — illegibility perhaps Confusion as to my precise requirements can be discounted as detailed specifications were given.

Perhaps, after all, my handwritten letters are the cause. Computer companies have a marked propensity for distributing glossy handouts (rich in pictures, short on information) at the slightest provocation. If inquiries were received in the same form perhaps more attention would be given to them.

Clearly, little business can be expected from one who writes in ballpoint. To be set against this is the fact that I have encountered no such difficulties when inviting tenders for the supply of a system.

Could this be a modern 'Riddle of the Sphinx'? Will some enterprising sprog see the potential for a new arcade game 'Find a Leasing Company'?

John Hewitt
Selby, N Yorks

Mail-order malingerers

Why, I ask myself, do certain British micro manufacturers insist on a total lack of effort to produce friendly customer relations, continually feeding us half truths and outright lies. It'll be available soon, it does not have as many features as we first expected, but for an extra few pounds, etc, etc.

I sent off for a package and a few days later I received an apologetic letter from the company saying the cassette was in stock, but the accompanying book was not yet released.

I must say that this came as a surprise, because the entire package has been advertised a number of times over the past months, and I was under the impression that that to advertise unavailable goods contravened some consumer protection act.

Thus another customer is alienated through a company's apparent inability to keep its customers happy.

Should this letter come to the attention of Acorn, please note: not everyone with a BBC micro only wants to shoot aliens in various guises in various ways, where are the language ROMs, second processors etc we were promised when we spent our hard saved money on your machine?

On a more happy note, congratulations on a very well presented, interesting magazine. My only complaint being the very large percentage of games reviews devoted to the Spectrum, there being many other machines deserving support.

Stuart Plaister
Newport, Gwent

We do try to keep a fair mix of machines in Gameplay, although sometimes there seems to be a bumper crop of new Spectrum programs. But I take your point — Ed.

The Juki's just a gem

Your review of the Juki 6100 daisywheel printer (June 30-July 6 issue) was very interesting. I have used a Juki extensively over the past month, and am very impressed — so much so that Hilderbay is supplying the Juki. As always happens with something new, we made a few mistakes at first (largely due to the rather incomprehensible manual). The paper loads automatically to the fifth line with the cover on without trouble on our machine and others we have seen. We had no difficulty changing daisywheels: if simply dropped in, the Juki engaged the slot correctly nine times out of ten (if it fails, try again).

Two problems can arise in interfacing the Juki to a computer. If an 'intelligent' parallel interface is used it will do things to the control codes such as send a linefeed after every carriage return, etc. This is fine for the typical dot matrix printer, but disastrous for a daisywheel used with word processing software. In the mode used for word processing, carriage returns are used after every word (the printer carriage responds by moving very slightly). If lots of linefeeds are added, you get several blank lines between words! We initially used an Apple II with Format-80 (a British word processor which does very fancy proportional spacing) and an Epson parallel printer interface card. After phoning the authors of Format-80 we realised what was happening, and wrote a (9-byte!) routine which bypasses all the interface card's cleverness: the results were perfect.

The other interfacing problem may be less usual. We were using a standard interface which we had used before: the Juki failed to respond (this happened when we were exhibiting the system at a show, of course). We thought that we must have damaged the printer in transit. Back in the office, it worked again with another identical interface. We finally discovered that changing a particular chip in the interface to another of the same type but different make made all the difference! (Both chips were of reputable make, and worked with all other printers).

Mike Salem
Hilderbay Ltd

A few lines on Microsoft

I fear I must disagree with the letter written by J Skidmore (*PCN* issue 17) condemning the Microsoft Basic line editor.

The commands are easy to learn, and are represented by single letters (eg D to delete).

The provision of search and kill facilities is also very welcome. Speaking for the two micros which I use (a TRS 80 and an ACT Sirius 1), the so-called useless 'x' command, which Mr Skidmore states acts just like pressing Return, in fact serves to extend the current edited line — a useful function indeed!

Surely the 'x' must be a typo, since the 'useless' function described actually refers to the 'E' command, which terminates the editing session.

The worst editor that I have had the misfortune to confront is the screen editor employed by the Apple II, where simple text insertion into a program line requires jumping in and out of the edit mode and the use of various Escape sequences for cursor movement — somewhat confusing! No doubt the provision of cursor control keys (as found on other micros) would help alleviate some of the problems.

Alistair Moffatt
Coulport, Cove.

ROUTINE INQUIRIES

Lost in a maze of bits and bytes, trapped in a forest of errors, or bugged by Basic? Whatever your problem, access our HELP function . . . better known as Max Phillips.

Write to: Max Phillips, Routine Inquiries, *Personal Computer News,* VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

Pop art on the Oric

Q I'm glad your magazine is distributed in the Netherlands. As an Oric owner, I enjoy the programs and tips. Could you explain the function of the POP and PULL statements? The manual doesn't help and experimenting hasn't given me an answer.
H J Ten Brinke,
Groningen, The Netherlands

A POP and PULL do complex little jobs. Fortunately, it's unlikely you'll ever actually need them . . . most Basics don't have equivalents. Looking at POP first, its job is to remove the top return address of the GOSUB-RETURN stack.

When you call a subroutine with GOSUB, the Oric remembers where you called it from. Then, when you execute a RETURN, the Oric leaps back to the statement just after the GOSUB. The place where the Oric remembers this 'return address' is called the GOSUB-RETURN stack. It's called a stack because it is a *pile* of numbers. After one GOSUB, it looks like this:
RETURN ad1

If that subroutine GOSUBs to another subroutine, you get:
RETURN ad2
RETURN ad1

And so on. When a subroutine ends at a RETURN statement, the Oric takes the top return address and carries on with the program at that point. So normally you can GOSUB-RETURN until your heart's content. Provided you stick to the GOSUB-RETURN pair, the Oric handles it all automatically for you.

But there are times when you want to get out of a subroutine without going back to where you came from. POP lets you do this. It just forgets about the top address on the stack.

To see it working try this program:
10 PRINT "MAIN 1"
20 GOSUB 100
30 PRINT "MAIN 2"
40 END
100 PRINT "SUB 1 PART 1"
110 GOSUB 200
120 PRINT "SUB 2 PART 2"
130 RETURN
200 PRINT "SUB 2"
220 RETURN

Run the program and make sure you follow what it's doing. Now add line 210 POP. When you RUN the program, the POP in subroutine 2 will 'pop' the return address set up by line 110 GOSUB 200. Leaving just the return address of LINE 30 on the stack. So the RETURN on 220 goes straight back to the main program without going near SUB 1.

What use is this? You'll find people who've worked with assembly language use it more often than those who don't. It's main use is getting out of nested subroutines when an 'error' occurs.

Perhaps you have an option where pressing Escape always takes you back to a main menu. Rather than setting a flag, RETURNing and testing for the flag, you could just POP the subroutine and GOTO the menu. Obviously, you have to be very careful about where POPs get you . . . once you're several subroutine levels deep, POPs make debugging very hard.

PULL works in much the same way for REPEAT-UNTIL loops. Its effects are much less tangible because you can often be leaping out of unfinished REPEAT loops with no apparent ill-effects. Still, if you insist on leaping out of such things, you might as well do it in style and PULL the REPEAT address before you go.

A ROM do on the Vic

Q I own a Vic 20 and use the following program to print out a list of Basic commands and error messages from the Vic's memory:
10 FOR A = 49913 TO 49959
20 PRINT CHR$(PEEK(A));
30 NEXT A
40 FOR A = 50039 TO 50055
50 PRINT CHR$(PEEK(A));
60 NEXT A

I was wondering if, by changing the values in these locations, new Basic words and different error messages could be produced. If you can't do it this way, how can you do it?
Neil Merer,
St Helens, Merseyside

A Yes . . . that would work. The problem is that changing those memory locations isn't easy. They, like the rest of Basic, are in ROM. You can't just POKE it. Short of blowing new ROMs for the Vic, what can you do?

You can get at Vic Basic and add in new commands and doubtless create your own error messages. It's possible on all versions of this Basic and you will have seen toolkits that do it. However, I can't see the novelty of your own messages being worth the trouble.

Don't give in to Brainfade

Q I cut my home computing teeth on a Video Genie. Last year, attracted by hi-res graphics and on-screen editing, I upgraded to a Newbrain A. Now I find myself in an unsupported wilderness as far as software and magazines are concerned.

I can ill afford the cost but I feel I must change again. My choice is the BBC micro. Is it possible and practical to restrict my purchase to a BBC Model A while using the additional memory and the advantages of the Z80A as a second processor?
G K Allisstone,
Hemel Hempstead, Herts

A It doesn't sound a good idea. Acorn and Torch have had enough problems getting the Tube to work. Attempts to connect a Newbrain unaided (even with its technical manuals) won't be fun. Probably the best you could do would be to get the RS423 interface fitted to the BBC and connect it to the Newbrain comms port. Good fun and useful for certain applications but not exactly mainstream home computing.

Your choice is really to go for a BBC Model B (you could sell the Newbrain) or stick where you are. BBC Model As were never a good idea . . . Acorn has now lost interest in them. You'll find it very frustrating to discover everything you fancy only runs on the Model B.

Alternatively, give your Newbrain a chance. Software, program listings and articles are beginning to appear. Even Grundy has produced some of the add-ons it has been advertising for longer than is decent. And do join a Newbrain user group. The Newbrain is a nicely put together system. But it needs to come in out of the wilderness if it and its users don't want to be left out of things.

Spectrum's in with the BIN crowd

Q I don't seem to be able to find the user-defined graphics on my Spectrum. If I am typing in a listing and it requires 'graphic A' or 'graphic F', all I get is a letter 'A' or 'F' and not some amazing alien.

The Spectrum manual is very vague and after numerous attempts at button pushing, I still find myself out of luck.
G Winstanley,
Sale, Cheshire

A You could spend a lot of time looking for the user defined graphics . . . a shame since you've already found them. The thing about user-defined graphics is that you (the user) have to define them. That is set their shape to amazing aliens or whatever. Until then, they are set to default shapes . . . the letters A to U.

So there are two things that might happen in a listing for you to type in. The listing may have the user defined graphics separately with a little program to load them. If so, follow the instructions for entering/saving them first before entering and saving the main listing. In this case, you should see the characters when you actually enter graphic 'A' or whatever.

The other more common way is for the program to define the characters when it is run. Lots of BIN and POKE USR statements are a dead giveaway for this method. In this case, enter the program exactly as it is. The first time it is run, it will set the shape of the user defined characters for the rest of that session. After running the program, try listing it. You should see the 'graphic' letters changed into the relevant shapes.

To learn more of this magic, try the manual from the bottom of page 92 onwards. Once you try these things for yourself, they become a lot less vague.

The Vic's roaming RAM

Q Could you explain how the standard RAM on a Vic 20

varies from 3.5K to 5K. It is quoted as 5K in Databasics but the machine I have seems only to have 3.5K.
Jonathan Phelan,
Jedburgh, Northumbria

A The Vic really has 5K RAM. The figure of 3.5K is how much RAM is available to you when you switch on. Some of the precious 5K goes on memory for the screen display, memory for the tape buffer and other odds and sods including the space needed for Basic to think.

So it depends on whether you quote 'total RAM' or 'RAM free to Basic' which figure you use. It is possible, with a bit of work, to reclaim some of the 1.5K back from the system. Locations 828 to 1023 are just used as a cassette buffer and could be POKEd as a data store for example.

A decimal pointless exercise

Q I'm writing a simple program to totalise invoices for my grocery business. But it seems that my Spectrum doesn't like decimal points. Here's an example:

```
10 LET a = 34.93
20 LET b =  5.24
30 LET t = 40.17
40 PRINT a + b
50 IF a + b<>t THEN PRINT
   "ERROR": STOP
60 PRINT "OK"
```

The result is "ERROR". Why? How can I avoid this?
Paul Calleja-Gera,
Cheltenham, Glos

A More floating point fun. Computers can't hold all decimal fractions accurately . . . bits are frequently lost and rounded. What actually happens and how bad the errors are depends on who wrote the maths routines in the Basic. In your example above, the Spectrum doesn't do too well.

All that is happening is that the result of the addition and the value used for variable t are different. They may look the same because the Spectrum will round both values before printing them. But somewhere along the line, there are bits that are different.

In accounting programs, you should ensure that arithmetic is as accurate as possible. In your example, the simplest dodge would be just to convert the numbers into strings before comparing. They will both be rounded before being placed in a string. Replace line 50 with IF STR$ a + b = STR$ t THEN PRINT "ERROR":STOP.

If you still have problems, avoid decimal fractions. Do your calculations in pennies. All the best people do. The most desperate technique in Basic is to avoid floating point altogether. Keep your numbers as digits in strings and write routines to add, multiply strings and so on. It may be slow. But the answers are right!

Dangerous structure noticed

Q I have been bombarded with the virtues of structured languages. All I want to know is what is a structured language and what are all these bad habits that Basic teaches me?

I've used lots of Basics including Sinclair Basic on the Spectrum and BBC Basic. I've been told that BBC Basic is a fairly structured language but, if this is so, I am sticking to Sinclair Basic. I can write anything I can write in BBC Basic in Sinclair Basic and I get really annoyed that I can't jump out of loops or arrays without losing the data.
Brian Williams,
Clwyd, North Wales

A A so-called structured language is one that helps you (even encourages you) to write in a structured fashion. This involves programs divided up into sensible debuggable modules written in a neat, organised manner. There are all sorts of fiddly details such as using a set number of recognisable forms . . . REPEAT . . . UNTIL, WHILE . . . WEND etc. But if you try reading about it, you'll discover that it's basically commonsense programming.

BBC Basic is 'fairly structured' because it has words that make life easier. Things like multi-line functions, defined procedures help to produce manageable code. On to the famous bad habits. These sins involve chaotic programming . . . such as leaping in and out of loops.

No-one would stop you writing programs this way. After all, the most important part of programming style is delivering a working program at the end of the day. But if you do let the GOTOs get out of hand, you'll end up working harder trying to debug the thing.

Scaled a new PEEK in microcomputing? If printed your tip will earn you a fiver.

If you've got something to crow about . . . a bit of magic that'll make the world a better place for micro users, then send it to *PCN* Microwaves—our regular readers' hints and tips page. We'll pay you £5 if we print it. We'll pay you even more if your little gem gets our vote as microwave of the month. Think on . . . and write to Microwaves, *PCN*, 62 Oxford Street, London W1A 2HG.

More control on the BBC

BBC users with MOS 1.0 onwards will know that the default codes generated by the function keys can be used to enter teletext colour changes in MODE 7. For example REM *Shift-F1* HELLO has the 'HELLO' in red.

The Control-Function keys can produce even more surprising results. Try PRINT *CTRL-FO*. In MODE 7, this produces the number 3584 . . . the value of PAGE. *CTRL-F1* produces TIME, *CTRL-F2* is LOMEM and *CTRL-F3* is HIMEM.

CTRL-FO produces a value of 144 or &90. On page 484 of the user guide, it gives &90 as being the token for PAGE. So this method works by entering a token directly from the keyboard — strange but handy to know.

G S Evans,
Farnborough, Hants.

Oric addresses DOKES and POKES

The following addresses may be useful to Oric programmers. 621(#26D) is the base address of the text screen. This is normally 48000 but DOKEing it will stop the top lines from scrolling. For example, to stop the top seven lines from scrolling, DOKE with 48000+7*40 that is DOKE 621,48280.

Also useful in this context is 623 (#26F) which is the number of text lines on the screen. Normally 27, POKEing this location will reduce the size of the text screen. As an example, to have a scrolling window from lines 13 to 27 with lines 1 to 12 fixed on the screen, try program 1.

C R Burnham,
Rose Hill, Oxford.

```
10 CLS: FOR A=1 TO 12: PRINT "LINE"A: NEXT
20 DOKE 621,48480: REM BASE ADDR + 12 LINES
30 POKE 623,14: REM 14 LINES TO SCROLL
40 FOR A = 1 TO 100
50 PRINT "THIS LINE WILL SCROLL"
60 NEXT
70 DOKE 621,48000: REM RESET BASE ADDR
80 POKE 623,27 : REM RESET LINES/SCREEN
```

Program 1: a scrolling window for the Oric.

Dragon manual modified

Many Dragon users believe that USR1 to USR9 do not work and resort to redefining USR0 for several uses. These functions do work but their syntax is wrongly described in the manual. There should be a 0 before the USR number. Try this program:

```
10 DEFUSR1 =
&H8015:'MOTORON
20 DEFUSR2 = &H8018:
'MOTOROFF
30 A$=INKEY$: IF
A$="" THEN 30
40 IF A$=CHR$ (13)
THEN
A=USR01(A):GOTO 30
50 A=USR02 (A):GOTO
30
```

The program simply turns the cassette motor on if ENTER is pressed and turns it off if any other key is pressed.

S Ward
St Helens, Merseyside

Newbrain screen dump

This short program dumps the Newbrain's screen to a printer, assuming it's on stream #8.

```
10 REM ** SCREEN DUMP
**
20 PUT 12
30 FOR I= 1 TO 24
40 PUT 5: LINPUT#, A$
50 PRINT#8, A$ : PUT 0
60 NEXT I: END
```

This can be handy while debugging your own programs or it might make a useful subroutine to actually use in them.

Quintin Gardner,
Croydon, Surrey

```
10 CLS: CLEAR 400,&H6FFF
20 FOR I=&H7000 TO &H700A: READ A$: P
OKE I,VAL("&H"+A$):NEXT
30 DATA 4F,B6,70,20,B8,70,21,B7,70,22
,39
40 INPUT "ENTER TWO NUMBERS ";A,B
50 POKE &H7020,A:POKE &H7021,B
60 EXEC &H7000
70 D=PEEK(&H7022)
80 PRINT A;" EOR ";B";;" = ";D
```

Program2: how to EOR two numbers together on the Dragon.

EOR—what a scorcher . . .

The Dragon does not have a bitwise Exclusive-OR feature. The short Basic program above (program 2) contains a machine code routine to let you EOR two numbers together.

A W Smart,
Newport-on-Tay, Fife.

Octagonal Dragon

The dragon can handle octal constants as well as decimal and hex. Just put &O in front of the number. So PRINT &O*number* will convert *number* from octal to decimal. It's surprising the things you can find in Tandy Color Computer manuals.

M Frary,
Dereham, Norfolk.

Spectrum's Enter INKEYed

INKEYs on the Spectrum won't read the shift and enter keys. If you need these, you can use the IN function as follows: IN(65278) equals 254 if Caps is pressed. IN(32766) equals 253 if Symbol shift is pressed and IN(49150) equal to 254 indicates that Enter is pressed. You can check for combinations of these keys by using the AND operator.

John Isaacs,
Bournemouth, Dorset.

New noise on Oric

If you're bored with the Oric's predefined sounds and find inventing your own a bit fiddly, these calls may come in useful. CALL#FB03 for a low click CALL#FB12 for a steady 'white noise'. CALL#FB30 produces a buzzing sound and CALL#FB40 gives a high pitched sound. Finally CALL#FBCO produces various sounds depending on when it is called.

S Hammet,
Bexley, Kent

Capital idea for Spectrum

Spectrum users who have tried to alter the cursor type from within a program may have come across a problem. In chapter 25 of the manual, a system variable called MODE is described as setting the cursor type. Unfortunately, POKEing this has no lasting effect.

Fortunately, you can achieve the same effect by POKEing FLAGS2. So POKE 23658, 0 sets the cursor to L and POKE 23658,8 locks the cursor in C mode.

David Jones,
Edmonton, London N9

New NEW for Beeb Basic

PCN Microwaves in issue 18 featured K Wolstenhome's nethod for NEWing a running BBC Basic program. Mr Wolstenhome presumably has a Beeb with Basic I because the new Basic II starts with:

```
8000 CMP &1
     BEQ &8023
     RTS
```

So the Beeb 'vanishing trick' would probably be better if the Accumulator was set to 1 before the CALL. So to make a program vanish after it has run, use A%=1:CALL &8000.

P K Hopkins,
Withington, Manchester

Newbrain cursor elevated

One feature missing from the Newbrain's Editor is the ability to send the cursor to the top of the screen when a long page is open. Home (PUT 12) is not what is needed. The following program may help:

```
1000 a = PEEK(92) +
  PEEK(93)*256
1010 a = PEEK(a+9) –
  PEEK(a+10)
1020 FORx =
  1TOa:PUT11:NEXTx
```

Dave Gunthorpe,
Birmingham B16

Having discovered the limits of the Atari Richard Hawes shows how add-ons can boost it.

Driving made easy with the Atari

A disk drive is a useful add-on to any computer. And on the Atari it gives you access to more programs and programming languages, as well as all the usual advantages over cassette such as speed and reliability.

To use a disk drive from Basic the computer needs an extension to its own operating system. This extension is called the Disk Operating System (DOS). There are a number of disk operating systems on the market for the Atari, the most common being Atari's own DOS 2.

Atari's own 810 is also the most commonly used disk drive. This drive is single density and single sided, giving approximately 90K of data storage per 5¼in floppy disk, although disk drives with larger storage are available. Each drive comes with a built in controller, and up to four 810s can be attached to the Atari.

DOS 2 takes up roughly 8K of the Atari's memory. For this reason, it is not practical to use the disk drive on a 16K machine, although it can be done. You normally would require at least 32K of memory in your 400 or 800 in order to use it.

Once DOS is in the Atari's memory, you have two main ways to control the drive. The first is through the DOS commands offered by the further extension to DOS called the Disk Utilities Package (DUP). The second is through the commands offered by Basic.

Basic programs held in memory can be stored onto a disk using the SAVE command. This stores your program on the disk in a tokenised, memory saving format, along with the variable name table. The command requires you to specify cassette or disk and a filename.

You also have the option to add an extension to the filename. This is usually used to describe the type of file saved (Basic program or data file for example). The command looks like this:

SAVE"Dn:filename.ext"

The device name for disk storage will be 'D' and a number from one to four specifying on which disk drive the data will be saved. If no number is specified then a default of drive 1 will be assumed. The filename can be up to eight characters long. The first character must be a letter from A-Z, but the rest of the name can consist of any letter and any number. Punctuation is not permitted and all letters must be in upper case.

The extension is optional and added by separating it from the filename by a full stop. It can be up to three characters long, and can consist of any number or capital letter.

The companion to this command is the LOAD command. This is used in exactly the same way as the SAVE command to retrieve named files recorded on a disk, and erases any program already in memory. The Basic command RUN can be extended to load and run automatically a program saved onto disk, substituting RUN for SAVE as in our previous example.

In the same way the Basic commands LIST and ENTER can be extended to store and retrieve files using the disk drive. Using the LIST command however does not tokenise the program as it saves it nor does it save the variable name table. This command can also be used to store specific line number ranges to a disk.

The ENTER command does not erase the program existing in memory and can therefore be used to merge programs. If you used a routine a lot in your programs it could be listed to disk and entered into memory each time you wished to add it to a program.

All of the commands mentioned so far require no additional setting up of the disk drive before use. But some commands can be used to access the disk drive more directly. In order to use them a channel has to be specially opened, with the OPEN command in the format:

OPEN#n,op,0, "Dn:filename.ext"

The 'n' is the number of the channel selected — DOS 2 allows eight channels to be opened simultaneously. The 'op' is a number specifying the type of access required to the disk drive, and these are all shown in figure 1. The next number that 22▶

Disk options available through the XIO command

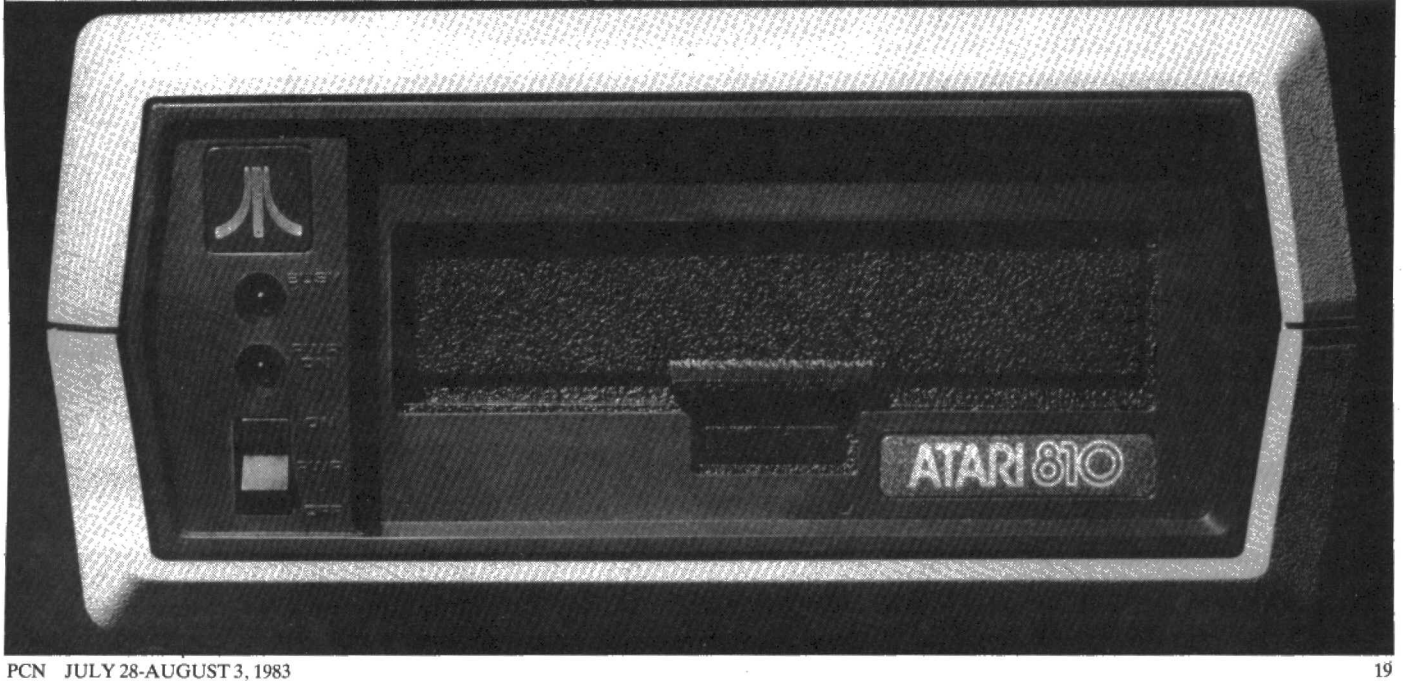
Number	Operation
3	Open channel
5	Input
7	Get
9	Print
11	Put
12	Close
32	Rename file
33	Delete file
35	Lock file
36	Unlock file
37	Point
38	Note
254	Format disk

Figure 2

Disk options available with the OPEN command

Number	Operation
4	Input only
6	Read directory only
8	Output only
12	Input and Output

Figure 1



should be specified is always a '0' when using disk drives.

There is also a CLOSE command to shut off the file when it is finished with, as a file that is left unclosed will become corrupted. The Atari automatically CLOSEs all files when the end of a program is reached.

The Basic command INPUT can be extended to enter strings from the disk within a specific file:
INPUT #n;var,var

The 'n' specifies from which open file to INPUT the string. The first variable is where the first amount of information is read into and subsequent variables, (including string variables), can be added to read in more than one bit of information at a time. PRINT is used in the same way to store information, variable by variable, to disk, and NOTE and POINT are used to step around the files randomly.

With NOTE, the first variable will contain the current sector number (1 to 719) and the second variable will tell you the byte number (0 to 124) of the next byte to be read or written by the computer. POINT allows you to specify exactly where the next read/write operation will occur.

PUT and GET give direct control to file handling, and are very similar to INPUT and PRINT. They deal with reading/writing only one byte at a time in the form PUT #n,var.

We have already mentioned that there are a number of disk control commands available through the DUP, including formatting disks, locking and unlocking files. Most of these functions can be implemented from Basic through the use of the XIO command. The utility program on the right includes some of these.

By using the XIO command in the form XIO cmdno,#chno,0,0, "Dn:filename.ext", you can perform a number of operations. Those related to disk access are shown in figure 2. The 'cmdno' determines the type of operation and '#chno' is the number of the channel used.

This program uses high line-numbers. This is so that once you have typed it in, you can LIST it to the disk and then append it on to your own programs.

```
2 REM **DISK UTILITIES SUBROUTINE **
4 REM **COPYRIGHT R.A.HAWES JUL83 **
6 REM ** SILICA ATARI USER'S CLUB **
20005 DIM A$(12),B$(12),C$(30),D$(10):C$="D:":D$=","
20010 GRAPHICS 0:? :? :? "    DISK UTILITIES"
20020 ? :? "    ==== ========="
20030 ? :? "1) RENAME FILE"
20040 ? :? "2) DELETE FILE"
20050 ? :? "3) LOCK FILE"
20060 ? :? "4) UNLOCK FILE"
20070 ? :? "5) FORMAT DISK":? :?
20080 ? "ENTER A NUMBER FROM 1 TO 5";:TRAP 20080:INPUT NUM
20090 IF NUM<1 OR NUM>5 THEN 20080
20095 TRAP 20650
20100 ON NUM GOSUB 20150,20250,20350,20450,20550
20110 C$="D:":GOTO 20010
20150 REM RENAME FILE
20160 GRAPHICS 0:? :? "RENAME FILE"
20170 ? :? "ENTER OLD FILE NAME ";:INPUT A$
20180 ? :? "ENTER NEW FILE NAME ";:INPUT B$
20200 C$(LEN(C$)+1)=A$
20210 C$(LEN(C$)+1)=D$
20220 C$(LEN(C$)+1)=B$
20230 XIO 32,#1,0,0,C$
20240 RETURN
20250 REM DELETE FILE
20260 GRAPHICS 0:? :? "DELETE FILE"
20270 ? :? "ENTER FILENAME TO BE DELETED ";:INPUT A$
20280 C$(LEN(C$)+1)=A$
20290 ? :? "HIT Y TO DELETE ";C$;" ";:INPUT B$
20300 IF B$<>"Y" THEN RETURN
20310 XIO 33,#1,0,0,C$
20320 RETURN
20350 REM LOCK FILE
20360 GRAPHICS 0:? :? "LOCK FILE"
20370 ? :? "ENTER FILE TO BE LOCKED ";:INPUT A$
20380 C$(LEN(C$)+1)=A$
20390 XIO 35,#1,0,0,C$
20400 RETURN
20450 REM UNLOCK FILE
20460 GRAPHICS 0:? :? "UNLOCK FILE"
20470 ? :? "ENTER FILE TO BE UNLOCKED ";:INPUT A$
20480 C$(LEN(C$)+1)=A$
20490 XIO 36,#1,0,0,C$
20500 RETURN
20550 REM FORMAT DISK
20560 GRAPHICS 0:? :? "FORMAT DISK"
20570 ? :? "CHECK DISK AND TYPE 'Y' TO FORMAT ";:INPUT A$
20580 IF A$<>"Y" THEN RETURN
20590 XIO 254,#1,0,0,"D:"
20600 RETURN
20650 ? :? "ERROR NUMBER ";PEEK(195);" HAS OCCURRED."
20660 ? :? "RE-STARTING PROGRAM"
20670 FOR T=1 TO 800:NEXT T:RUN
```

Interface and boost use

To get the maximum use from an Atari disk drive system, you really need the Atari 850 interface module as well. Although your work area may seem to get cluttered with power supplies and cords very quickly (the Atari disk drive system with interface module needs no less than *three* external power supplies) its worth making the room.

The interface module increases the number of devices you can plug into the peripheral I/O connections on the computer, by giving you two separate I/O connections at the front (one for the line going into the computer and one for the line going out to the device), four serial interface outputs and a parallel output. It also has a second processor, gives you more memory and the ports are programmable.

Now, the movie of the program of the story . . . Geof Wheelwright on micro-video links.

Program an action replay

Computers and video equipment are the darlings of the 1980s consumer technology renaissance, so it should come as no surprise that attempts have been made to marry them.

While the video recorder is not likely to be anyone's answer to cheap mass storage in the near future, it can play an important back-up role for your computer. Making a habit of feeding the computer's video signal through a VCR (video recorder) every time you sit down for a long programming session can often buffer you against program crashes.

By videotaping your programming, you can:

a) give yourself a permanent on-screen record independent of normal disk or tape storage;

b) analyse how you developed your program, to get perspective on how you approached the problem and perhaps prompt ideas for alternatives;

c) take a frame-by-frame look at graphics animation and look at ways to make it more realistic;

d) put off the decision to buy a printer, as the VCR can perform much the same function with an electronic 'hard copy' as a printer can with a paper version;

e) make better use of the two most expensive pieces of electronic hardware you're likely to buy (barring perhaps the home stereo — which can also be integrated with your computer).

Just how you hook up your micro to a VCR will depend somewhat on your computer. Ironically, the cheapest computer in the country is also the easiest to integrate with a VCR.

Because it has no colour graphics and no sound, feeding the Sinclair ZX81's video signal to a VCR is simple.

All popular home video recorders have a socket at the back for a TV aerial and all you have to do with the '81 is hook up that TV lead from your machine to the VCR's aerial socket and tune it to around Channel 36 UHF.

Then turn on the computer, set the VCR to record and away you go. Videotapes can hold up to four hours of programming per tape, so you needn't be too worried about having enough videotape to make real use of the video-computer link-up.

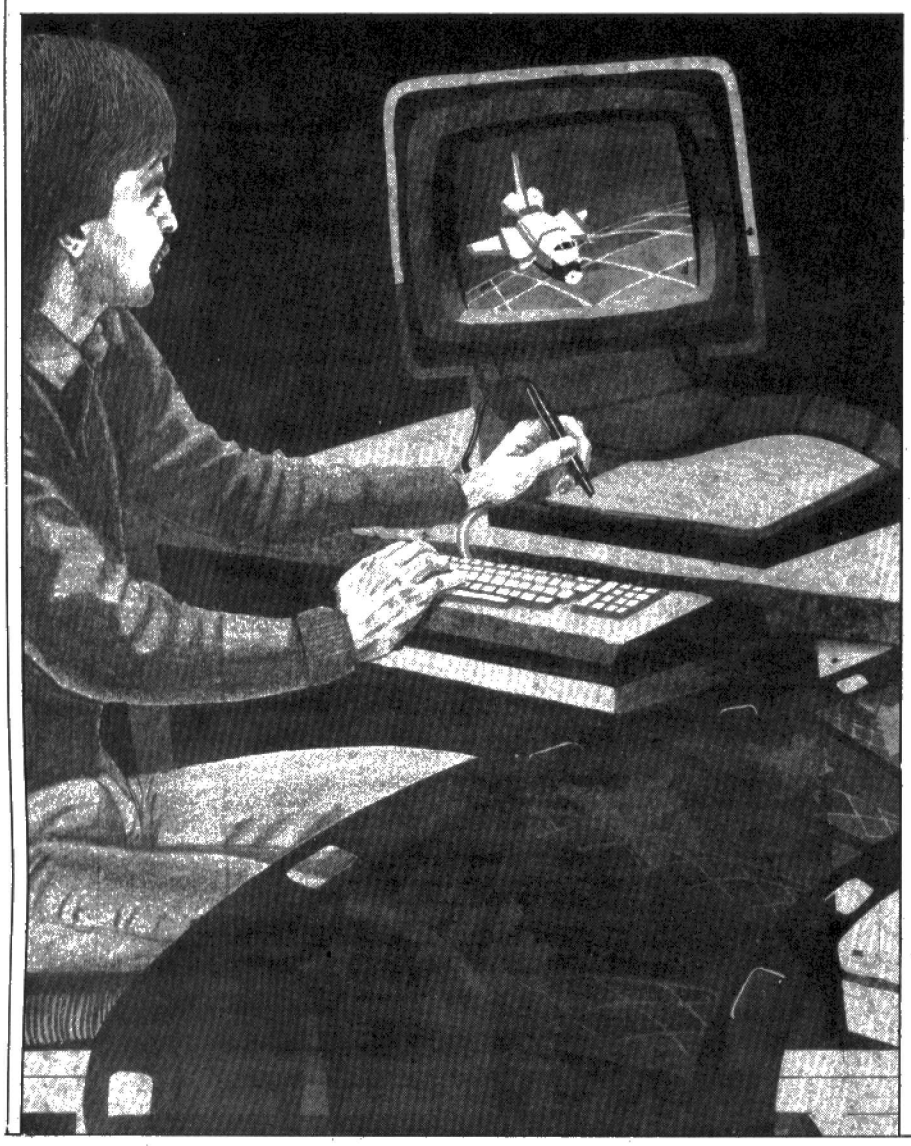
And if you use, for example, one of the increasingly popular four-head video recorders to record a ZX81 signal, you'll be surprised at the quality of the freeze-frame of your computer signal on playback.

The problem arises when you start using colour computers or computers that route their sound through the VCR's speaker system.

In order for a television or VCR to reproduce either colour or sound they must have a stable and synchronised signal. That job is carried out by a sync pulse generator. If that generator is not receiving either a strong or stable enough signal from your computer it will be unable to keep hold of the signal long enough to either display or record it reliably on the VCR. This applies to sound as well. Care has to be taken in trying to record through the TV sound on machines like the Texas Instruments TI99/4A, the Commodore Vic-20 and the Atari.

While the ZX81 can be great buddies with your VCR, its sister computer, the colour Sinclair Spectrum often becomes estranged from the machine by virtue of the fact that its colour TV signal is (to put it politely) sometimes erratic.

There are no hard and fast rules for finding out which video machine will work with which computers, although we can offer a little advice from a series of extensive tests.



■ the Ferguson range of video recorders seem to handle the signals of a number of popular micros including the BBC micro and the Spectrum without too much adjusting to get a stable colour signal.

■ a video recorder with manual tuning can more easily hold a strong computer signal than machines with 'automatic search' facilities.

■ Sony televisions are often the best for producing good colour pictures on a Spectrum.

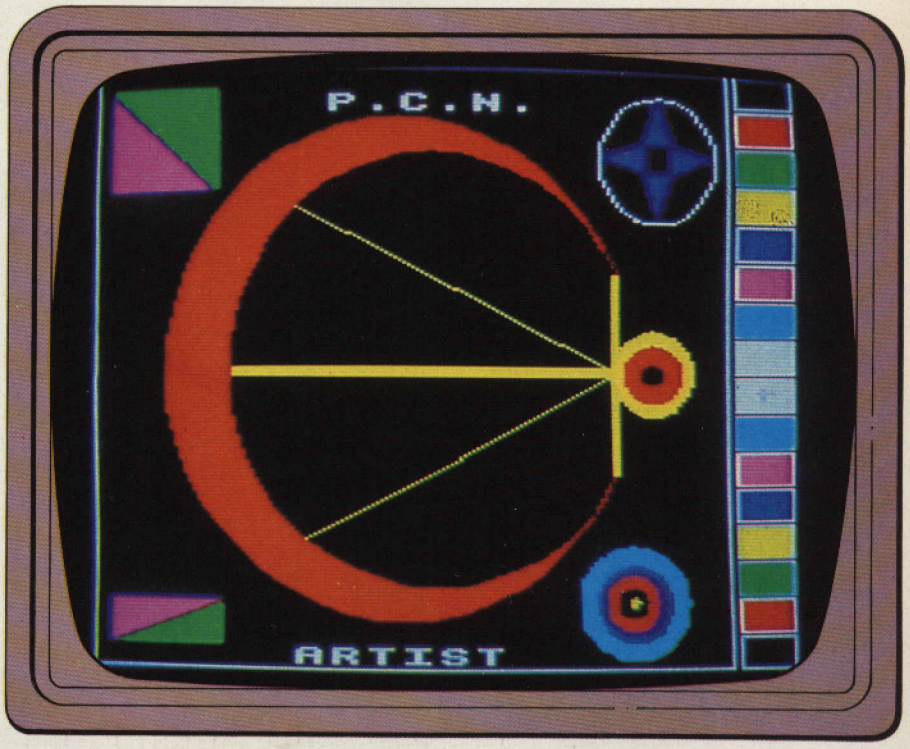
But once they've been hooked up to the Sony video recorder the system seems to suffer such interference problems that neither the TV picture, nor the computer signal on videotape is clear.

■ even a Hitachi video recorder using a two-year old design and tuning mechanism can tune into the signals generated by most micros.

If you've got designs on your micro, Nigel Cross draws his conclusions on two packages for the BBC.

Computing as art on a BBC

Price £12.95 (disk) Grafkey £7.95 (tape) Grafstik £7.98 (tape) **Publisher** Clares 06065 51374 **Other versions** None **Outlets** Clares



Graphics packages and systems come in many varieties and prices, and this suite from Clares for either disk or cassette is reasonably priced and offers many features. The system under review was the Grafdisk version and arrived as a disk and three pages of notes to act as instructions. This seemed a bit scanty at first glance but, in fact, it was adequate to run the system with no problems.

Features

Normal operating allows you to use standard geometric shapes such as line, triangle, rectangle, text, and circle: Techniques available to you include rubber banding, colour choice, paint and fill options.

Getting started

The starting procedure is somewhat long-winded with page after page of instructions. It's a good idea to arm yourself with pen and paper on your first attempt with this package. Once through this initial procedure you are offered the opportunity of being able to inform the system as to the drawing device — joystick or keyboard. I tried the keyboard option.

In use

A tear-off ruler for the function keys resides at the bottom of the first page of the notes and is most useful. This strip shows all of the 18 facilities available, with 9 of them accessible through the use of function key 9 (acting in lieu of the shift).

Of this package's features, the facility using fill as a toggle allows either solid or outline shapes from the selection. This is a good feature as long as you remember which mode you are in. Paint is an interesting function which allows both "doodle" and variable "brush" widths; it seems such a shame that this facility does not allow finer control of width viz. point to block to bigger block etc. — Todd Rundgren did a version of this feature in one of his programs once!

Colour choice turned out to be very restrictive and seemed to allow only foreground changes. Even so, the palette allows 16 coloured boxes down the right hand side of the screen filled with the colours from which you can choose in the mode you have selected — 2-colour, 4-colour or full 16-colour. Perhaps a small routine could be included in future versions to allow you to re-assign physical/logical colours so that better pictures can be generated in the higher resolution modes. Also, it wouldn't take a great deal of effort to allow changes in background colour.

Cursor control for all picture drawing is dealt with by either joystick or the cursor control keys and can operate at 2 speeds toggled by the space bar. This feature certainly speeds up the drawing sequence without losing accuracy and can be no bad thing.

The strong point of this package is its ability to do fully-fledged multi-point rubber-banding. This is a technique for creating a complex shape using 1 to 4 points, where the lines from each point are attached to the mobile cursor giving the effect of rubber-bands being pulled from those points. This facility gives you far greater accuracy and control when you need to handle a number of lines connected to an apex.

Pictures can be SAVEd and LOADed to and from disk in one of 2 methods. The first method is to save the picture array (about 1K) and thereafter load this array into the program and then display it accordingly. The other method is to perform a full screen save (about 20K) and the display on screen outside the program control.

For those who wish to incorporate graphic designs in their own programs there is an extra program on the disk called Redraw. This is a procedure which can be appended to your own programs and thus allow stored picture arrays to be loaded into the program and then displayed. What a boon to those of us who enjoy adventure games with fully displayed locations!

Verdict

This package could make a worthwhile addition to anyone's program library. I hope that Clares manage to maintain their promise of continuing enhancement yet still keep the price within reasonable bounds. As a bonus for those who purchase the disk version, new updated versions will be available at only the price difference.

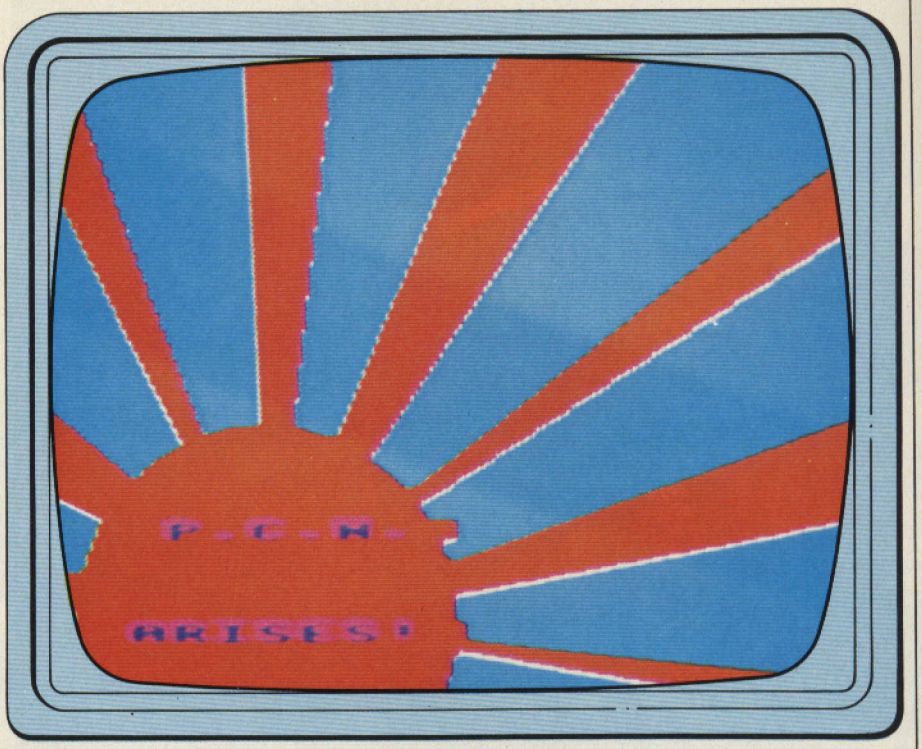
RATING

Features	
Documentation	
Performance	
Userbility	
Reliability	
Value	

30 ▶

Toolkit for design

Price £9.95 (tape) £12.50 (disk) **Publisher** Computasolve 01-390 5135 **Other versions** None **Outlets** Computasolve.



This package has a lot in common with Grafdisk, both in the people at which it is aimed, and the kind of features it has on offer. It also comes both on cassette and disk. I used the tape version, and a joystick — though you can also control it with the keyboard. It comes with a small instruction booklet.

Features

After the title page and the loading procedure have been completed the main menu is displayed. This menu allows colour changes, saving of pictures, loading of pictures, change of mode (4 or 5 only), draw/edit, complete with a set of standard geometric shapes, exit and the facility to dump the contents of the picture to a printer — Epson MX80 is currently programmed.

Colours are changed in this system by function keys 0 to 3 for the two modes available. These have default values of black, white, red and yellow, but can be assigned many of the full range of colours for the machine. Function key 0 is assigned to background but you need to remember that only 4 colours can be displayed at once.

In use

Picture saving and loading take about 4½ minutes, so should be done only when you're happy with the end result. Display mode can be changed while the program is running but there is a drawback to this. Due to the two available modes being mutually exclusive any display currently on screen will be deleted.

The facility to dump the screen contents to the printer is an excellent idea and takes only about 4 minutes on an Epson MX80.

Having selected and assigned the appropriate mode and colours then you can get into the drawing itself.

In the drawing routine the function keys 0 to 3 allow you to change foreground colour at will. An optional edit facility also exists allowing individual pixels to be changed to the colour of your choice by using a magnify function. This is an exceedingly powerful tool for graphic design and allows remarkable accuracy.

The draw facility contains all the standard sort of features you would expect, lines, triangles, quadrilaterals, circles, rings and text. And I found that the line facility goes in from just one single point to another, a pseudo-rubber-banding technique that is exceptionally responsive under joystick control.

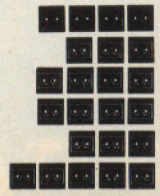
FACILITY	GRAFDISK	DRAFTMATE
No. of modes	5 (0,1,2,4,5)	2 (4,5)
Change mode	Yes	Yes—deletes current picture
No. colours	2,4,8 (+8 flashing) (fixed)	2,4 (according to mode)
Foreground	according to mode—palette select	(user definable)—function key select
Background	Black only	User definable
Lines	Yes	Yes
Triangle	Yes—solid/outline	Yes—solid only
Rectangle	Yes—solid/outline	Yes—solid/outline
Circle	Yes—solid/outline	Yes—solid/outline
Text	Yes	Yes
Save picture	Yes—by array or screen	Yes—by array
Load picture	Yes—by array	Yes—by array
Print	Yes—not stored in array	Yes—Joystick only
Alignment grid	Yes	Yes
Multi-point R/Band	Yes	No
Drawing tool	Joystick, keyboard	Joystick, keyboard
Edit	By over-drawing	magnify area, adjust solo pixels copy to picture

Verdict

This is a well thought out program with plenty of useful tools to help you create difficult graphics drawings and would be well suited to the first-time computer artist.

RATING

Features
Documentation
Performance
Userbility
Reliability
Value



An assembler for the Newbrain? Walter Knight takes a look at the operation behind the brains.

Assembler of order

The problem with writing programs in Basic is that although the language is easy for humans to follow, it's virtually meaningless to the machine. It doesn't take long to discover that the most efficient way to get your micro to sit up and beg is to give it orders in machine code — those baffling lists of hex pairs. An assembler lets you enter your commands in assembly language, then converts it into machine code, which can be listed as a series of data lines to be read as part of a Basic program.

Features

Brainzap by Andrew Pepper, from Watkiss Computers, is an assembler/editor program for the Newbrain that lets you type Z80 assembly language directly onto the screen, checks it as it is entered and arranges it in one of a number of formats according to choice.

The program is written in Basic, and is supplied on cassette. Both these features mean it is slow to load and use, but they do mean it can operate on the unexpanded Newbrain, which is a boon to those of us who are starting small!

Within the limitations of its format, Brainzap assembles the full Z80 instruction set, contains an interactive editor, and can output the listings in four different formats to screen, tape or printer.

Presentation

The review copy arrived in a clear plastic envelope, containing the cassette in the usual flip-top box, and a 12-page instruction leaflet. The instructions assume a fair amount of knowledge on the part of the user, and would-be students of assembly language are recommended to read Rodnay Zaks' book *Programming the Z80* for detailed instruction.

Most of the leaflet is taken up by a description of what the program will do, what will be seen on the screen as it happens, and how to enter information. At the end, there's a sample program (printed with an annoying disregard for the difference between zero and O).

Unfortunately, there is less in this than meets the eye, because the sample program as printed cannot be entered. It requires a CALL to a subroutine HEX-ASC (to convert hex to ASCII) which should have been input in an earlier exercise which does not appear in the leaflet. Watkiss Computers hopes to be able to send a revised instruction set to all who have already bought the program.

In use

Brainzap loads easily from cassette — my copy took six minutes to get almost 400 lines of Basic into the Newbrain. A line of reverse video (black on green) then appears asking 'Do you want reverse video? y/n.' Once you have made your choice, the screen clears and a prompt appears consisting of the amount of bytes left in memory (the Newbrain function FREE) and a flashing > cursor.

The syntax required is well explained in the instructions, with lines to be entered in the form:

10 DSROOT: LD A, 16 ;load counter. In the example 10 is a line number (unusually required by Brainzap), DSROOT: is the label, LD A, 16 is the op-code and arguments, and ;load counter is the comment that reminds you what you thought you were doing when you entered the line.

There are no on-screen prompts, so keep the manual close by until you are familiar with the nine single-letter error codes that may appear– I?? reports an unknown or illegal instruction, U?? reports an undefined label, and so on. I couldn't crash it — attempts simply produced error report I?? and the > prompt.

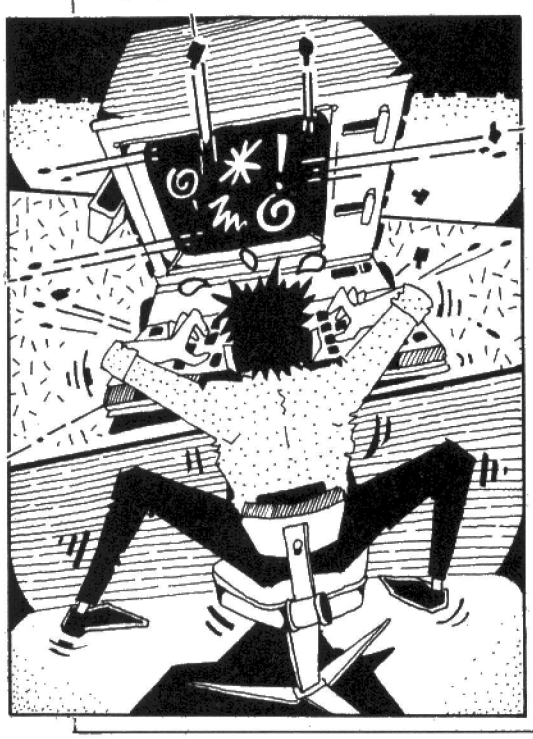
The manual is disarmingly frank about Brainzap's limitations. 'Brainzap', it says, 'doesn't do everything! They're right there; indeed it doesn't.

Some illegal instructions can be passed (this is a function of a program written in Basic to take up as little memory as possible) and, like the manual says, 'Brainzap can be slow'. On average, it took about seven seconds to compile each line on the command LIST.A, which lists to the screen an assembled version of the current program.

The assembled form is not stored, so each LIST.A command will take the same time to execute — the same is true of LIST.M for hex pairs of machine code and LIST.D, which produces the machine code in data form with Basic line numbers. Programs can be saved and loaded in the same forms, and listed to the printer with TYPE. The program cannot handle macros, micro-instructions, or relocatable-code format; everything other than line numbers must be entered in hex, and attempts to enter long programs tend to produce error code M?? — short of memory.

None of these limitations — they are all in the manual — detract from the fundamental value of the program.

Gary Davies



Verdict

This is the first assembler I have come across for the Newbrain, and I wasn't disappointed. Given a reasonable understanding of the workings of the Z80, Brainzap is a valuable tool.

The manual could have been more carefully checked — it really should be possible to enter and run the sample program as listed, for example. But overall, it's certainly extremely good value for the money.

RATING

Features	■■■■
Documentation	■■■
Performance	■■■
Useability	■■■■
Reliability	■■■■■
Overall value	■■■■

Name Brainzap **Application** Assembler/editor **Price** £9.95 **System** Newbrain **Publisher** Watkiss Computers, 4 Ninnings Lane, Radley Heath, Welwyn, Herts (0438) 812439 **Format** Cassette **Language** Basic **Other versions** None **Outlets** Mail order

Ian Scales encounters a small creature with abilities in robotics and graphics.

Micros turn turtle with the Zeaker

Computers are best known — and most used — for manipulating data, whether it's in the form of business finance, words or galactic mega-distruptors in a game.

But micros also have the capability, as yet little used in the personal computing field, of directly manipulating physical objects.

Now this area might be about to get a whole new lease of life. The coupling of even small-scale robotics with Britain's biggest-selling micros opens a realm of possiblities, and Colne Robotics has done just that.

Its entry into the field is the delightfully-named Zeaker Micro Turtle, not just a turtle for a micro but a micro-turtle measuring just 5in × 5in × 2in.

Turtles are now better known as on-screen graphics devices but the origin of the species was a robot in the way of the Zeaker.

The turtle wheels its way about a flat surface wielding a pen under control of the micro. Because the computer actually controls a physical object rather than an electronic image, educationalists greeted turtles with ready acceptance.

But there is no reason why these fun creatures should remain in the domain of education. Colne Roberts has put them into the hands of hobbyist.

The Zeaker was originally released for use with the BBC Micro but a new version is available for both the ZX81 and the Spectrum. The good news is that it only costs £79, including VAT, or £59 if you're prepared to build it in kit form.

Presentation

The *PCN* test model worked with the Spectrum via the edge connector. The Zeaker and its power pack are cased in white plastic and although we received a bare interface board, the production model will no doubt come with a similar casing.

Two ribbon cables connect the interface to the controller and a single, two-metre 'umbilical' cable runs from the controller to the turtle where it is held aloft by a type of gantry to stop it becoming twisted.

Instructions to control the turtle are entered in a high level language — Snail Logo in the Zeaker's case.

All the turtle can do is move forward, backwards, left and right, and raise or lower the pen. The beauty of the concept is that it's easy to get immediate results while you can build up quite complex programs to achieve good graphics with the minimum of keystrokes.

The Zeaker also possesses a set of touch-sensitive bumpers so it can sense and react to objects it encounters. It would be possible, therefore, to run it through a maze and get it to find its own way out — with the appropriate software, of course.

Documentation

The documentation supplied with the Pro-Test model was very much in rough form, but as much of the advice necessary to get going with the system relates to the writing of Snail Logo one imagines that the final documentation will draw heavily on CP Software's own User's Guide which seems adequate enough.

Fortunately, there is not too much "talking down" undertaken here — the documentation has an 'adult to adult' feel about it.

In use

Lets have a look at Snail Logo itself. Those magical words 'high level language' mean that the user, conversly, needs a relatively low level of computer understanding to get to grips with it.

FORWARD N — moves the specified number of steps in the current direction.
BACKWARD N does the same in the opposite direction.
RIGHT N — Rotates the current direction clockwise by the specified number of degrees.
LEFT N — Does the same but anti-clockwise.
REPEAT N — Causes all instructions following to be repeated the specified number of times.
RFINISH — Terminates the REPEAT effect.
SNAIL — Causes a Snail symbol to be displayed at the end of each track.
NSNAIL — Cancels the Snail effect.
DOWN — Causes the Turtles tracks to be visible (pen goes down).
UP — Pulls the pen up.

These are examples of the commands available in Snail Logo.

Like Basic, Snail Logo stores a series of easy to understand commands. Each command executes a block of machine code when it's called up by the program — rather like building a prefabricated house.

Like house-building the prefabricated approach in computer programming makes the whole thing easier but compromises somewhat on a programmer's flexibility. Like the prefabricated house builder you're limited to a relatively small set of combinations.

As far as program levels go Snail Logo is even higher on the scale than Basic. As mentioned earlier, when manipulating a Turtle you only have a certain number of options anyway — forward, back, and so on. It's how you combine and repeat them that's most important.

Snail Logo's main feature is the way it can command the Turtle in a very 'English-type' way, without the imposition of a lot of numbers or comparatively complicated procedures.

When entering instructions you don't have to worry about line numbering, as you do when programming in Basic. Instead you simply enter a command. It reappears numbered and verified at the top of the screen a la Sinclair itself.

Snail Logo is loaded from Cassette in the normal way once the hardware has been configured. The normal sort of menu is displayed and after setting a couple of parameters you can get straight into the task of drawing things on bits of paper.

The example used in the Snail Logo documentation to introduce the newcomer is:

```
REPEAT 6
BACKWARD 1
RFINISH
END
```

REPEAT 6 indicates the number of times the operation below, in this case a backward movement of one step, is to be repeated. RFINISH tells the computer that the repeating procedure is over and END signifies the obvious. You can't get much simpler than that, can you?

Well, yes you can actually. Once this little program has been keyed in it is possible to define it as a separate procedure by giving it a name and number. So when you come to write another Snail program you simply include the procedure as a separate line.

To make it even easier the commands can be defined on the keyboard with, in most cases, their first two letters only. As many of the commands err on the long side (BACKWARD and FORWARD for instance) this cuts down on even more hack work.

Verdict

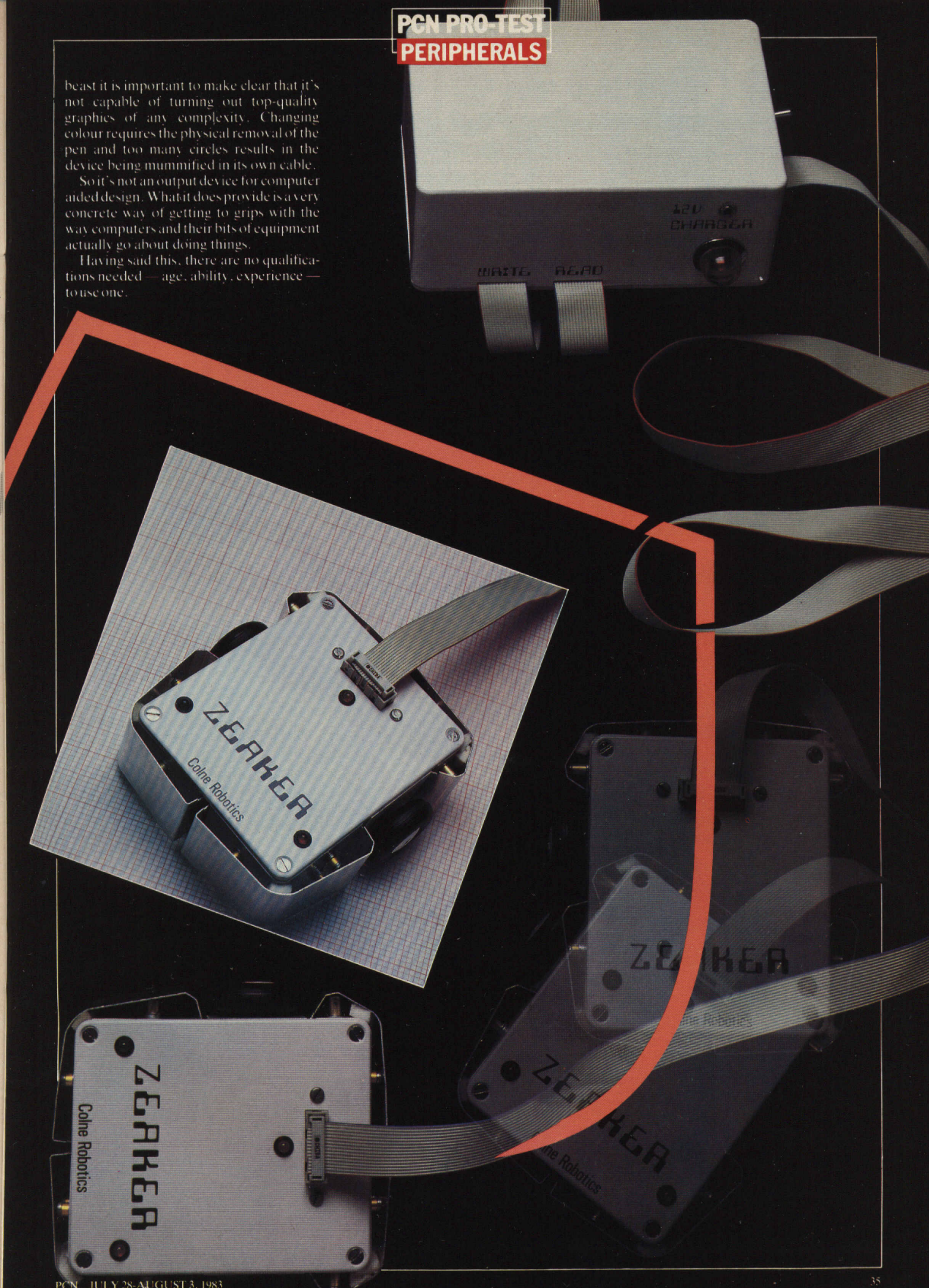
The Zeaker Turtle worked well, but was noisy. Although it's a very versatile little

Item Zeaker Micro Turtle **Manufacturer** Colne Robotics **Interface** ZX81 ZX Spectrum, BBC Micro. **Price** £79 inc VAT, plus interface for ZX81 £13, Spectrum £24. (BBC requires cable only) **Contact** (01) 892 8197.

beast it is important to make clear that it's not capable of turning out top-quality graphics of any complexity. Changing colour requires the physical removal of the pen and too many circles results in the device being mummified in its own cable.

So it's not an output device for computer aided design. What it does provide is a very concrete way of getting to grips with the way computers and their bits of equipment actually go about doing things.

Having said this, there are no qualifications needed — age, ability, experience — to use one.



David Janda examines the ins and outs of the newly released MCP-40 printer/plotter from Oric

Plotting with Oric

It is said that software can make or break a micro. If the software is no good then nobody will buy the machine. This, to an extent, is now true of peripherals. Users are not content with the basic machine — they want to add to it with printers, modem, joysticks and so on.

Oric Products International, which promised a variety of peripherals to go with the Oric-1, is now releasing the first of them: the MCP-40 printer/plotter.

The MCP-40 is the first printer available for the Oric-1. It will, no doubt, give the Oric owner an opportunity to do some hard copy graphical work as well as text processing (of sorts). The MCP-40's role as a plotter enables you to do some pretty neat graphical work, and this is shown on the printer demonstration cassette supplied with the printer.

Features

The MCP-40 has an impressive specification, with many features to be found on plotters at three or four times the price. For your money, you get four-colour printing or plotting, variable character sizes, and pretty good plotting definition (0.02 mm). There is software in a ROM inside the printer, and this provides a range of print/plotting features. Axes can be drawn, text can be rotated, plotting can be absolute or relative and so on.

All these features can be accessed from basic or Oric-FORTH. There is, however, manual control over colour select, line feed and paper change.

Documentation

The documentation supplied with the printer is quite detailed yet confusing in places. A brief section is devoted to setting the printer up to a computer — I didn't say the Oric, because it gets very little mention in the printer manual.

All the graphic and text commands are explained well enough and there is a long example program at the back of the manual for you to type in. I did and found that it has several errors!

In use

Setting up the printer was very easy although Oric omitted to say what amperage the fuse should be. I tried a 4A fuse and all worked well.

By default, the printer will give 40 characters per line, like the Oric screen. But as the Oric only uses 38 columns for listing programs, there will be a slight wrap-round if the line is long.

All the commands and control codes are passed to the printer by using LLIST. There are control codes for graphic and text modes as well as line feed and so on. The pass graphical information to the printer, the data has to be held in strings of text. So to change the colour of the pen to red you would enter:

10 PRINT CHR$(18): LPRINT "C2"

where C is the code to change colour

A few odd things happened now and then. The printout got corrupted with odd squiggles, and I found out that this is cured by turning off the keyboard scanning interrupts. Also, if you think that the TAB function works strangely on the Oric, it does so on the printer as well.

Using ',' as a separator caused text to be separated to a wide degree.

The four colours (red, blue, green and black) are in small cartridges which are placed into a barrel type pen holder on the printer. To achieve printing, the paper is moved up and down as well as sideways. When printing is in progress, a small lever on the bottom of the barrel is moved forward and this moves the whole barrel forward as well. The colours are changed by the barrel moving to the left of the printer where a small metal lever 'clicks' the barrel over to the required colour. The ink cartridges are good for 250 meters (825 feet).

Verdict

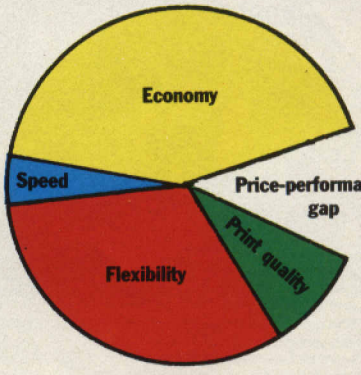
Throughout the tests, the printer worked well. Plenty of ventilation is supplied to the MCP-40 and there was no overheating.

The quality of output was fine, but the black could have been a little darker. Noise level was acceptable, but things tended to get loud when plotting was in progress. Another minor grumble is that the line-feed and paper change buttons are too close together.

For £170 I think the MCP-40 is a little overpriced. However, it does open up new areas of interest to Oric owners.

The biggest disappointment is that the Oric's alternative character set (the graphics) is not available on the printer. All you have is upper and lower case and numbers.

Product MCP-40 printer/plotter **Price** £169.95 inc VAT **Interface** Parallel **Machine** Oric-1 **Other versions** Tandy Colour Computer **Supplier** all Oric dealers.



A high printer capability in one direction will probably cause either a low capability in another or a higher price. Economy is a negative way of expressing price.

If a printer has lots of everything it will close the price/performance gap.

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
HIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmno
pqrstuvwxyz{|}~
```

Barry Miles is still down among the daisywheels seeking high print quality at medium cost.

Printing Triumph

The Triumph Adler TRD 170S is really a fellow-traveller with the Triumph Adler typewriter range. The idea is to kill two markets with one set of components. This printer works slowly because of its daisywheel typewriter mechanisms but it is cheaper than daisywheel computer printers because its development costs have been shared with the huge number of typewriter users.

The question is, does such a printer compromise too many features for the price saving?

Setting up

The machine arrived adequately protected in the traditional polystyrene overcoat.

It was apparent immediately that much effort had gone into the ergonomics of the design. The white and chocolate two-tone case was pleasing to look at, and smaller than usual. The supporting panel behind the platten was decorated with 10, 12 and 15 pitch scales, to assist in measuring.

The transparent lid which covered the platten and print mechanism rested on a foam base, which was about ⅛ inch wide, and inlaid into the surface. I noted no less than four guides to hold the paper firmly onto the platten, and three rubber rollers for the same purpose.

Lifting the hinged body of the machine (I understand that future models will cut off the power when this is done), I spotted that the dip switches were tucked away out of the reach of all but the serious adjusters of the machine, in a slot in the front panel. They were however, readily accessible to the determinedly-handled small screwdriver. Most of them do nothing at all, but the important one, switching automatic linefeed on and off, did. You can also set certain standard form lengths, and choose language variants.

The front panel contained some very smart touch sensitive switches. These control pressure of impression, on a scale of one to three, according to the thicknesses of paper being accommodated, on or off-line. This is important, because the printer powers up off-line, which is unexpected, and likely to cause a bit of frustration until you notice it. To set the top of form, move to top of form, or make a line feed, you press the switch for a long or a short time.

A self test takes place if you press both the switch for setting top of form and the impression switch at the same time. The complete character set is then printed out. This is worth doing twice, in order to satisfy yourself that printing is working in both directions.

The TRD 170S is rated at 16 characters per second at about one line, and 12 characters per second printing average Shannon 2 text. These are uninspiring figures, but there are extra factors to be considered. A wide range of daisywheels are available, in various pitches and styles, and a bonus from the slow speed is that the character scan is thin and elegant.

Ribbons are large snap-on cartridges in fabric, carbon, or multistrike carbon. The ribbon carrier has a lever to set the amount of ribbon transport to suit the pitch of the wheel you are using, which is good for economy.

Up and running

This is undoubtedly one of the most pleasant printers to use. The designers have thought the design through to its logical conclusion, and the results are pleasing. What I think they have done is to examine the nature of the work most frequently carried out on a daisywheel printer, and decided that it is short letters where quality matters more than speed, and easy paper alignment matters. If the printing comes out askew, a reprint is always necessary. The concept is that the total time from picking up the paper to removing the completed document is important. The loading of the paper is easy. Simply pull a lever towards you to release the bail bar, insert the paper behind the platten, then bring the lever further forward against the spring's resistance and the paper will automatically feed around the roller.

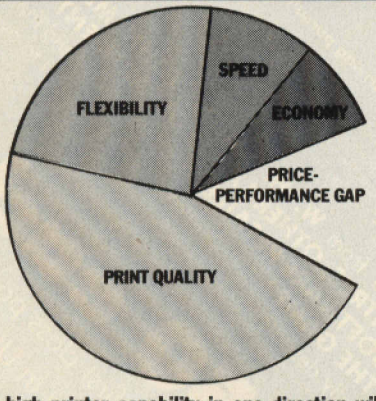
The fan is very quiet, and the printer makes very little noise indeed, rather like having a typist in the room with you.

The control codes offered by this printer are somewhat sparse, but arguably all that most people need. Backspace and underline allow you to overstrike, and produce perfectly underlined material. You can set a left margin of your choice from character position 1 to 256. It is possible to carry out linefeeds forwards and backwards, reset the form length, to set Bold and Shadow printing, and also Proportional Spacing from within software. Escape sequences will also print the six additional characters on the wheel. The speed of the machine was slightly understated.

Verdict

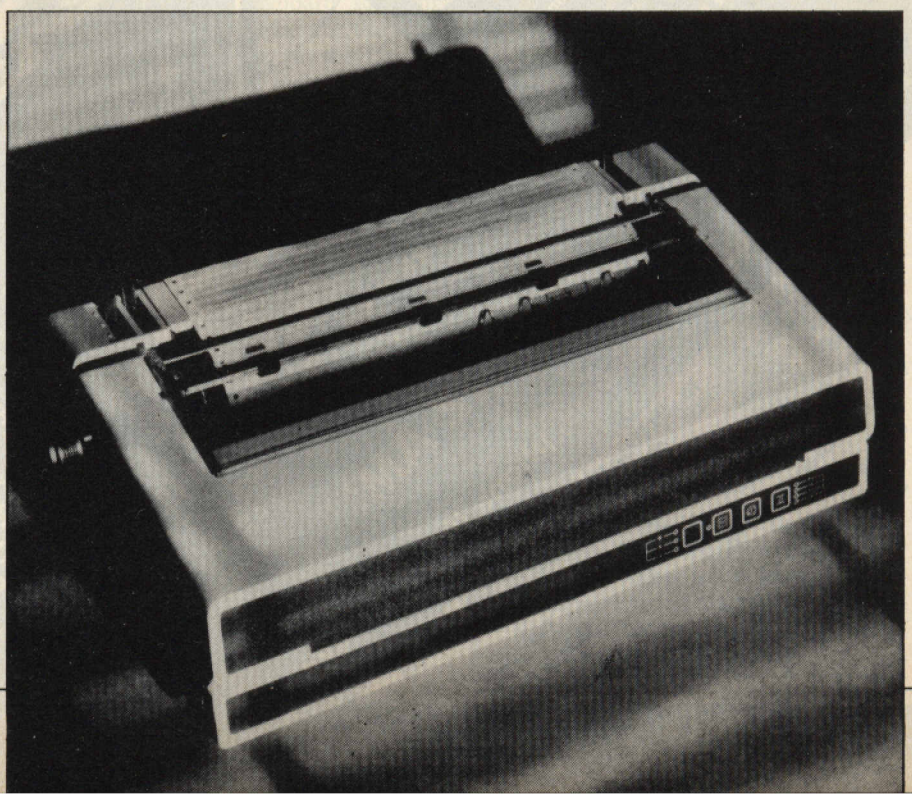
The total design concept seems absolutely right on this machine, the only problem is speed, and the tendency for the first double struck character to print slightly off to the right, so it looks like shadow printing, otherwise it is extremely attractive.

Product Triumph Adler TRD 170S Daisywheel printer **Price** £725 plus VAT **Interfaces** choice of Centronics, Qume parallel, RS232 and Diablo emulation **Extras** Optional tractor £125 plus VAT, mechanical sheet feed £595 plus VAT **Distributor** Triumph Adler (01) 250 1717



A high printer capability in one direction will probably cause either a low capability in another or a higher price. Economy is a negative way of expressing price.

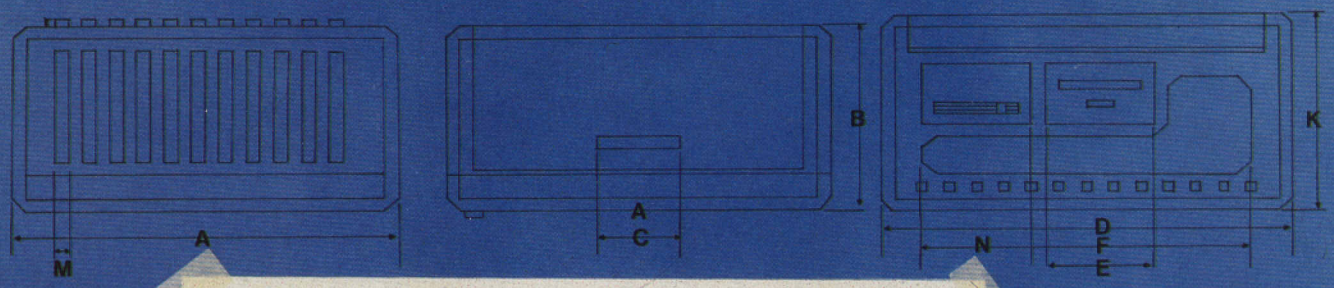
If a printer has lots of everything it will close the price/performance gap.

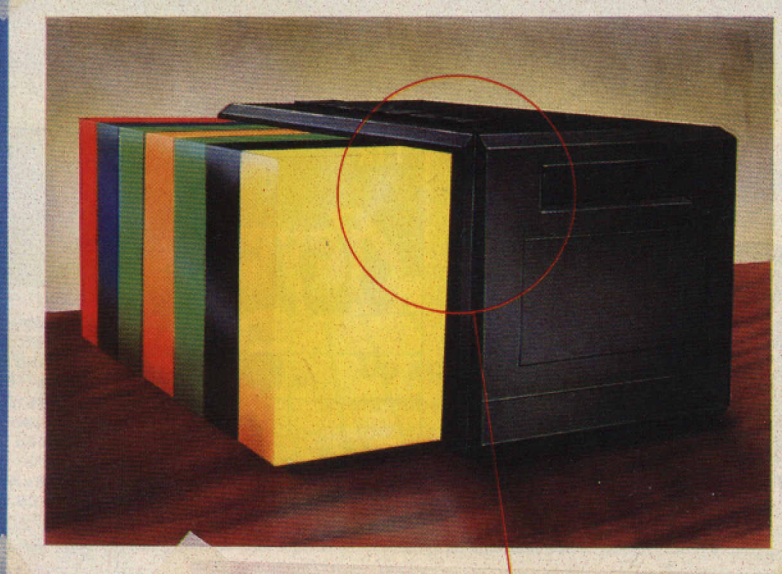


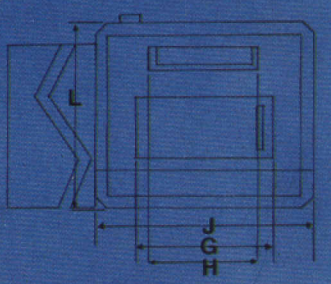
Ian McKinnell

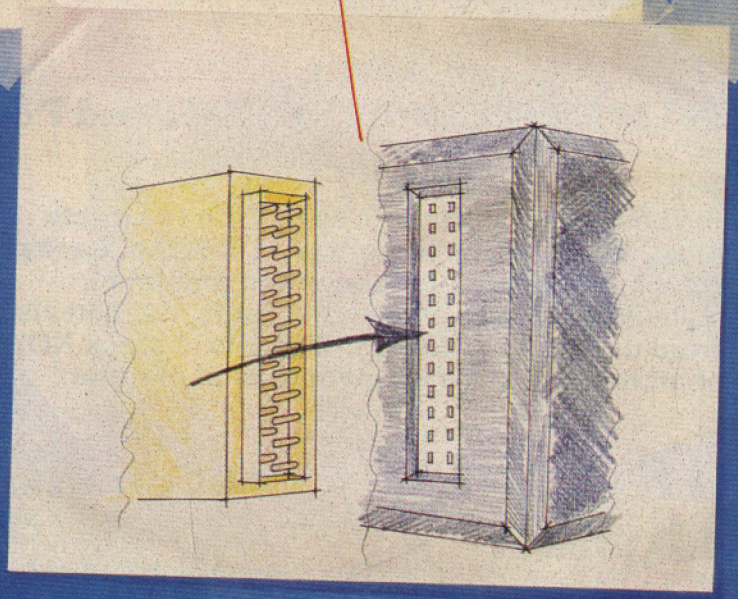
With a glance at past and future, Richard King mentally constructs a new breed of micro.

Midsummer's dream machine









Clockwise from top: front elevation, rear elevation, plan view of top and side elevation — computer aided design studies. Centre: an artist's impression of the final product. Various colour coded modules are plugged into the main unit. Bottom — a detail to show the protecting walls around the delicate connector pins.

Richard Dunn

A question of intent

There comes a time in the life of anyone who spends a lot of time looking at different examples of similar objects when the sheer number of the items under examination means they all begin to look the same.

The more so when the articles are computers. When micros were first introduced, they were all radically different. Each had unique features, and almost every one had some feature which made it outstanding.

But look around today — practically every one is cloned from one of three stereotypes. There's the Spectrum-type, the Apple-type, and the Box.

A major aspect to their conformity is that the Box types and many of the Apple-types will generally only work in one of two ways . . . CP/M or not, though to all appearances, they're identical.

There are undoubted benefits to be gained from standardisation, which needn't be restated here, but a question also arises. Namely 'Are the concepts which underlie these standards the correct ones?'

The problem lies in the fact that the way 'ordinary' computers are programmed necessarily divorces the operations required from the data which will be operated upon.

If the methods used are reversed, and the data is considered the important member of the partnership, with the program only being present in order to make a specific change, we get an altogether different outlook.

Most obviously, programming and programs lose a lot of mystique, and make most of the latter outmoded. At the same time, the analyst or information specialist becomes more valuable, as do the files.

Since analysing and judging is precisely what people do very well, the final result should be a much more approachable machine which works much the way people do, albeit faster. It would be more literal, rather less discriminating and possibly more fallible. But it would also be a little more accurate, and most important would be easier to control.

This is because 'nailing jelly' is extremely difficult, if not impossible. It's rather like pelmanism — you have to remember a lot, and while people are pretty good at remembering impressions, they aren't so hot when it comes to detail.

Since it is difficult to do at all, much less well, wouldn't it make sense for the computer to do the bits that it's good at, instead of working like a fancy typewriter?

Hence the 'alternative micro', which I have called the X-1 — a computer designed to work so that its operation accurately reflects the job it is supposed to do. It is described in detail here, specs and all, though, of course, it's an imaginary machine.

The main purpose of a computer is often confused with its operation. What it's actually meant to do is to change data from one state to another, by a process which is generally called a program.

The program is rightly considered a very important part of any computer-aided work, but this recognition has had the result that the data, which is the raison d'etre for any program, has been ignored.

The result is that programs are generally written with little or no regard for the data they will need. At best, variables common to one sub-problem are given related names, but related types or usages are generally ignored.

The X-1 is a machine designed with the approach that the only non-arbitrary factor is the data, and that any program is only another form of data, which in this case can be interpreted as a set of changes to data. The general idea is that if the principal object in the user's view is the data itself, and operations on it are shown as physical changes in the data, then a more understandable (and hopefully more useable) machine will result.

It doesn't depend on new technology, but on reorganisation of current technology, accompanied by re-packaging and re-programming.

Construction

The physical construction of the X-1 doesn't need to alter to conform to the philosophical principles stated, but since most machines are difficult to work on, it's worth looking at.

X-1 is designed on the Bauhaus principle that form should follow function. The casing is made of glass-filled plastic resin, and is about 14in long, 6in high, and 5in deep. Ventilation-slots are covered by perforated protective grilles mounted flush with the top and bottom, and the corners are slightly chamfered. Almost all the surfaces have some details worth examining.

All essential controls are accessible from outside, but mounted internally, so that only four long Allen screws, located at each corner, have to be turned to free the deep but essentially rectangular box of the top half of the shell of the main unit, leaving a shallow tray at the bottom.

Removing the top reveals the two main circuit-boards, mounted on edge to allow convective cooling. The front board has a special supporting brace to prevent damage when an expansion-module is plugged in.

The centre board carries a compact but complete 16-bit microcomputer, with plenty of RAM, a basic video-screen, disk-controllers and various ports. Behind is an extra slot, into which an expansion memory-board may be plugged.

The lower tray carries the weight of all items, and has a PCB mounted horizontally. This is used to carry the various inter-unit connections, as well as all the power-lines.

The underside has a series of shallow depressions, each almost but not quite bridged by a flat tongue, so that cables which may come from expansion modules can be led cleanly out to the back. Wrapping a cable around one of these tongues provides an adequate degree of strain-relief.

At each corner of the base is a large rubber foot, and a hole which marries with a toothed peg, so that the machine won't fall off its wall-bracket, if that's how it's mounted. The front appears to have a series of fine rectangular lines engraved on it. These are, in fact, spring-loaded doors. Pushing one causes it to swing in, revealing a 96-way DIN-connector.

The top surface has a row of large round buttons above these, running along the front edge. If you press one with the associated door held open you can see a pair of plastic bars move forward a short way. This is an ejector-mechanism, so the modules which plug into the connectors can be removed without damage.

Another important function is performed by the ejector-buttons, which have two distinct depression-pressures. The lighter one gives a signal to the base-processor, and the other actually shoves the module out of the connector. When a particular module gives the signal that it is being closed down (its button is being held down), the base-processor quickly informs any processes which may be using that module. This may involve terminating the process, initiating another module to the same task if one is free, or any other action which the user may have suggested as an appropriate course of action.

This slightly complicated procedure is necessary because the X-1 is meant to remain on all the time, even while field-repairs are being carried out, which may involve removing or replacing a module.

It has other advantages, too, since if the base-processor is faulty, a diagnostic module may be plugged in without shutting down. This can then take over control by forcing a priority bus-request, and can look at the base-processor as a module itself (which it is, in fact). The advantage lies in having the memory of the base-processor freely accessible, probably containing clues as to what happened when the fault occurred, and so permitting some chance of recovering the data.

The other side of the machine has a 'hood' which lifts up. Underneath are a series of different sockets, three parallel, three serial, several kinds of TV/monitor, tape and audio sockets. Each has an associated switch.

In the case of the serial and parallel ports, these are DIL microswitches, and multi-way miniature rotaries for the others. With them, preset configurations can be selected, but this is a convenience only, since many settings (in particular the parallel and serial ports) can be changed by software.

The ports are sufficient to allow reasonable access to the base-processor, and limited access to other modules, providing 1/0 for the keyboard, printer, (serial and parallel), plotter, modem, and terminal, as

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◀43

well as colour monitor (both RGB and composite) and modulated TV on Channel 36.

The cables are led out through the slot underneath the hood, which clicks into position, and can also be shut securely with a pair of sliding bolts. The hood itself is sufficiently thick to be as stiff as any other part of the case, protecting the delicate items under it, and allowing strain-relief clamps to be fitted to the cables.

The rear half of the top surface shows the front of a 3in micro-Winchester drive at the left end, with the opening of a 3.5in micro-floppy beside it, so the actual disk is popped out like a piece of toast.

Filling the rear right-hand third of the main unit is the power-supply. Since the X-1 is intended to remain on most of the time, this is not just a simple PSU with an on/off switch — there are special arrangements. On the top is a green indicator-LED to show that it's switched on, and a red one which is usually off.

On either end are deep depressions which serve as handgrips. Underneath each is a hatch with a small handle. Under the left-hand one are some buttons and a small LCD screen, 20 × 4 characters, as well as several LEDs.

The buttons perform fundamental checking procedures when pressed, and the result is reported on the screen. As a check, one of the LEDs lights for each major function. Using three-colour LEDs, the status can be shown — green for OK but not in use, yellow for OK and in use, and red for failed.

Under the right-hand end hatch is the power-switch. There are, in effect, two power-switches. One is an ordinary rocker-type, but beside it is a small Yale-type lock. The power will be locked on if this is turned to the on position while the rocker is on: if the rocker isn't on, the Yale can't be turned. This eliminates any possibility of the machine being started incorrectly. Reversing the procedure will power-down the machine.

In order to make sure that all these precautions are not rendered useless by a passing foot kicking out the power-cable, this is bolted into a socket with a large central screw running through the middle of the plug. Naturally, since the plug at the other end has to be some standard type, similar security is not automatically available, but it would be well worth installing something like this in the wall.

In fact, even if an accident does happen, it isn't fatal. When the power drops below a certain level the red LED lights, and at the same time a pleasant — but nonetheless highly noticeable — beep sounds for ten seconds.

This actually means that the emergency-batteries have been called on. When they're in use, the machine gives a disconsolate little sequence of three bleeps every minute. The batteries themselves are a set of high-current NiCads, charged from the mains and capable of supplying power to the machine for 30 minutes . . . enough to give the user time to tidy up the current job and close down.

If the user doesn't manage to complete this in time, the machine does its best to keep everything safe, so when the batteries have been used for 75% of their endurance it goes into the 'emergency shut-down' procedure. This involves copying the whole contents of the memory onto a special area of the Winnie, effectively saving the status, which then allows a safe (if not elegant) shutdown.

This also means that the user can't cause any major damage, even if he turns off the machine correctly, but without having ordered the termination of all subsidiary processes, thus taking the machine to Level 0 and closing all the files properly.

Recovering from such an event is fairly simple. When the power is restored and after the machine has gone through the booting process, it looks to see if the system-directory is marked as having a valid emergency-file. If so, a panic power-down must have occurred. The user is told about this, and asked if he wishes to attempt a return to the pre-emergency situation.

Answering yes will load the memory-image, and — we hope — the machine will then be in the same position as it was in when the panic happened. Of course, this isn't exactly the same, because the machine has been off in the meantime, so the memory-image, and all its associated processes, are now running at Level Start +1, *ie* as a 'supervised process'. This means much what it says . . . that the process now running is not the base-process, but is being observed by another process. I'll explain the effect of this later.

Storage

Storage on a machine like the X-1 will get used up pretty fast, so there's plenty of it . . . either 10Mb or 100Mb with vertical recording on the Winchester, and 500K on the micro-floppy, which would rise to 5Mb with vertical recording.

Both operate with cache-memory if this is possible and sufficient memory is not in use, and the proportion assigned to cache-usage can be allocated by the user at supervisor-level.

Expansion

As explained in the section on construction, the X-1 can take a range of expansion-modules. Modules come in two different flavours . . . intelligent or damned smart. An intelligent module is one which has some limited programmability, or a program in ROM which is executable by some processor. The other kind actually has a procesor of its own on it, and can thus function independently of the rest of the system, barring the need for power.

Provided the task accomplished by the module doesn't take up too much time and doesn't have to be done too often, an intelligent module can be used. Tasks

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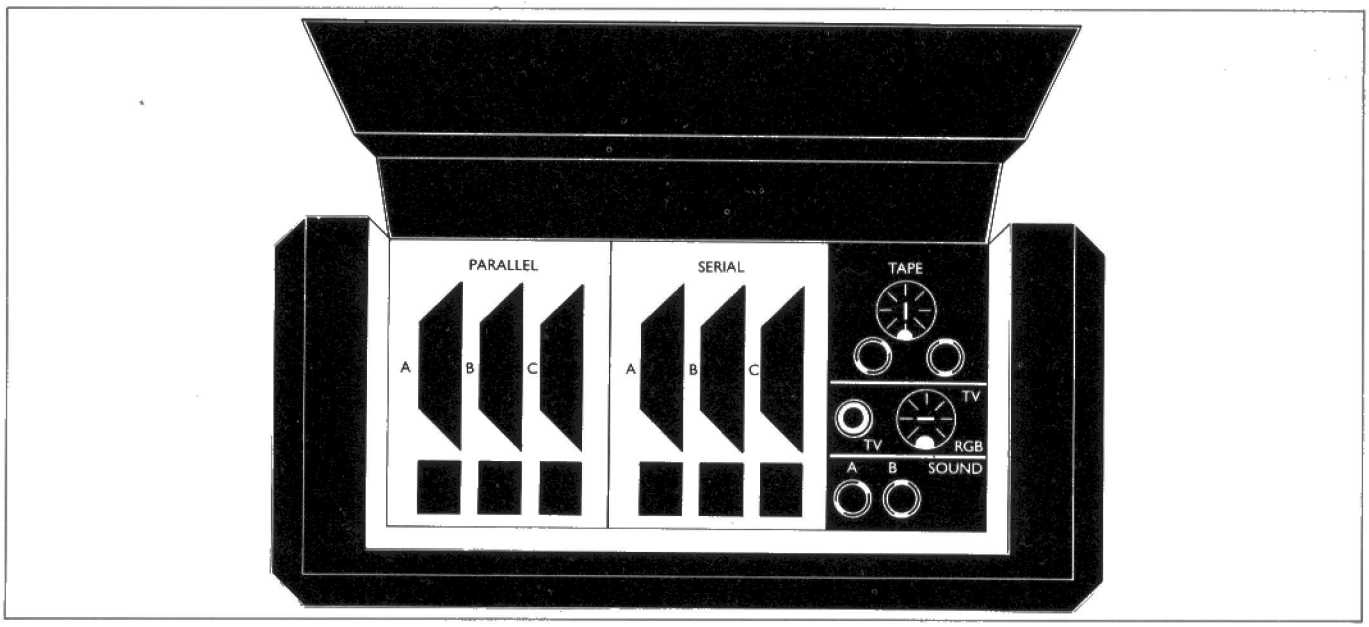


The rear hatch covers the main Input/Output connectors arranged in blocks. Parallel are at one end, serial in the centre, and the miscellaneous ones.

BBC SOUND DESIGNER

Last week's article explained how the ENVELOPE command worked and showed how it could be programmed. It is, however, a rather tedious command to have to keep typing in with all its parameters if you wish to experiment with it.

To conclude the series of articles on Sound on the BBC Micro, an Envelope Designer program is given here. It makes no claims to be the most sophisticated design program available, but it is easy to encode and understand and enables the ENVELOPE parameters to be changed easily.

When typing in the program take care not to confuse the '1's for 'I's and vice versa. The program simply lists all the ENVELOPE parameters on the screen and sounds the envelope.

Lines 50 to 80 set up an initial ENVELOPE

Lines 90 to 130 clear the screen and print the title double height

Lines 140 to 280 display the parameters

Lines 290 and 300 produce the sound

Lines 310 to 470 allow a new parameter to be selected, and then ask for a parameter value. There is no check on the size of the value as this would make the program much more complex and serves very little practical purpose.

Line 480 returns to the start of the display, where the new parameter value is displayed and the new envelope is sounded.

If no parameter is selected, or an incorrect one is selected, no parameter value will be changed and the same sound as before will be played.*

If you are doing any serious experimenting using this Envelope Designer, it will be found worthwhile to keep a notebook of useful or unusual envelopes produced together with a description of the sound. Even if it is not required at the time it is surprising how useful a collection of envelope commands can be when writing a program at a later date.

*To reset the program to the original envelope parameters, press ESCAPE.

Speech

There is also an option now to have the BBC speak it's mind as well as making music.

Acorn Computers has released a voice chip add-on for the BBC that uses the voice of veteran broadcaster Kenneth Kendall. The system produces words and sounds from a vocabulary contained within a word PHROM or Phrase Read Only Memory.

To encode speech in a binary representation, the speech processor uses a linear coding technique. The speech processor takes serial data provided by the PHROM integrated circuit and converts them into audible "words" under the control of the BBC's main CPU.

You can access and manipulate the 165 words already stored in the PHROM quickly and easily in Basic or assembly language.

Using Basic, the SOUND command is used, but with a variation: SOUND −1, (WORD NUMBER) 0,0.

The value of the word number determines which of the 165 words are stored in PHROM.

You can also make up new words by combining two words that are already supplied in the PHROM.

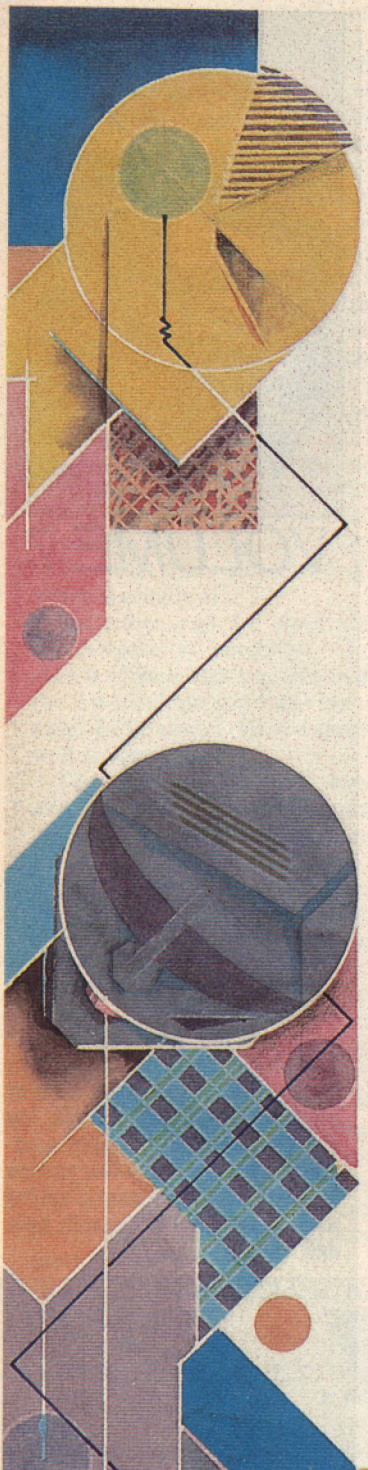
Meanwhile, the Basic sound commands require four parameters. The first parameter is read as a systems command, while the second command decides on the word spoken. Parameters three and four don't affect sound generation. but the system still expects them, so they must be included.

Parameter value 1 determines whether the computer obtains the word number from PHROM, RAM or an absolute value in hexadecimal.

The program below is a small envelope designer, written with the purpose of letting you encode and understand how the Envelope parameters are used.

To get the most out of this designer, keep a notepad and pen handy to take down any useful or unusual envelopes. As for the speech synthesiser, you're well-advised to bone-up on how speech is put together if you want to get the most from Acorn's 'Kenneth Kendall' chip.

```
 10 REM ENVELOPE DESIGNER
 20 REM PROGRAM BY MARTIN PHILLIPS
 30 ON ERROR RUN
 40 @%=4
 50 T=2:PI1=0:PI2=0:PI3=0
 60 PN1=0:PN2=0:PN3=0
 70 AA=0:AD=-1:AS=0:AR=0.
 80 ALA=126:ALD=0:P=100:L=50
 90 CLS
100 FOR N=1 TO 2
110 PRINTCHR$(141)"   ENVELOPE DESIGNER"
120 NEXT N
130 PRINT
140 PRINT"  T = STEP LENGTH    0/255 = "T
150 PRINT"PI1 = PITCH STEP -128/127 = "PI1
160 PRINT"PI2 = PITCH STEP -128/127 = "PI2
170 PRINT"PI3 = PITCH STEP -128/127 = "PI3
180 PRINT"PN1 = NO. OF STEPS   0/255 = "PN1
190 PRINT"PN2 = NO. OF STEPS   0/255 = "PN2
200 PRINT"PN3 = NO. OF STEPS   0/255 = "PN3
210 PRINT" AA = ATTACK RATE    1/127 = "AA
220 PRINT" AD = DECAY RATE  -127/127 = "AD
230 PRINT" AS = SUSTAIN RATE 0/-128 = "AS
240 PRINT" AR = RELEASE RATE 0/-128 = "AR
250 PRINT"ALA = PEAK LEVEL     0/126 = "ALA
260 PRINT"ALD = SUSTAIN LEVEL  0/126 = "ALD
270 PRINT"       PITCH           0/255 = "P
280 PRINT"       LENGTH         -1/255 = "L
290 ENVELOPE 1,T,PI1,PI2,PI3,PN1,PN2,PN3,
    AA,AD,AS,AR,ALA,ALD
300 SOUND &11,1,P,L
310 PRINT'"PRESS RETURN FOR REPEAT NOTE"
320 INPUT'"CHANGE WHICH PARAMETER? "Q$
330 IFQ$="T" INPUT"VALUE FOR T "T
340 IFQ$="PI1" INPUT"VALUE FOR PI1 "PI1
350 IFQ$="PI2" INPUT"VALUE FOR PI2 "PI2
360 IFQ$="PI3" INPUT"VALUE FOR PI3 "PI3
370 IFQ$="PN1" INPUT"VALUE FOR PN1 "PN1
380 IFQ$="PN2" INPUT"VALUE FOR PN2 "PN2
390 IFQ$="PN3" INPUT"VALUE FOR PN3 "PN3
400 IFQ$="AA" INPUT"VALUE FOR AA "AA
410 IFQ$="AD" INPUT"VALUE FOR AD "AD
420 IFQ$="AS" INPUT"VALUE FOR AS "AS
430 IFQ$="AR" INPUT"VALUE FOR AR "AR
440 IFQ$="ALA" INPUT"VALUE FOR ALA "ALA
450 IFQ$="ALD" INPUT"VALUE FOR ALD "ALD
460 IFQ$="P" INPUT"VALUE FOR P "P
470 IFQ$="L" INPUT"VALUE FOR L "L
480 GOTO90
```



SPEAK YOUR APPLE'S MIND

Speaking micros are generally about as welcome as anything else that tries to cage a slice of humanity within a lump of technology. So if a speech synthesis add-on doesn't actually sound like a human, it should at least atone for this deceit by being good value for money. This prejudice aside, what are the principles?

There are actually two major techniques for producing synthetic speech: first, via a combined process of recording and reproduction; and second, through modelling of the vocal tract.

Both have followed roughly parallel paths of development over the last century, from Johann Maelzel's talking doll (1823), through to Sir Richard Paget's Plasticene Resonators Producing Artificial Vowel Sounds (1924), and the speaking clock that used miniature glass records (1936).

The advent of cheap micro technology hasn't actually changed the essential principles of speech synthesis, but it has made both techniques more efficient and a good deal more flexible.

The modern-day equivalent of recording and reproduction with a glass record is where spoken words are digitized and stored directly in memory. Speech is produced when the contents of the memory are accessed and fed to the input of a digital-to-analogue converter (DAC) and amplified. The direct-storage method was used widely in the first talking calculators and by the first speech synthesis item produced for the Apple II, Mountain Computer's (then Mountain Hardware) Supertalker, a peripheral with on-board ADC (for sampling) and DAC (for synthesis), which appeared in 1977. This is now discontinued, but a bit of scouting around should reveal the odd one or two lurking for under £150.

The main disadvantage of this system, and the direct-storage technique in general, is the large amount of memory needed for even small amounts of speech. For example, the Supertalker operates with a sampling rate of 4 KH, meaning that 4K of RAM gets used up for every second of speech, and the 1.6 KHz bandwidth for the speech output results in a lot of high frequency detail disappearing in the wash. The only way of improving the quality of speech is to increase the sampling rate, but that automatically reduces the number of words per given memory space.

However, for all the drawbacks of speech synthesis by digitization, there are two major advantages to the direct-storage method: the speech is your own voice and adding a new word or phrase to the computer's vocabulary is simply a matter of digitizing it and storing it in memory.

Speech synthesis by digitization doesn't come to a halt with the demise of the Supertalker, and there are two other packages available for the Apple II.

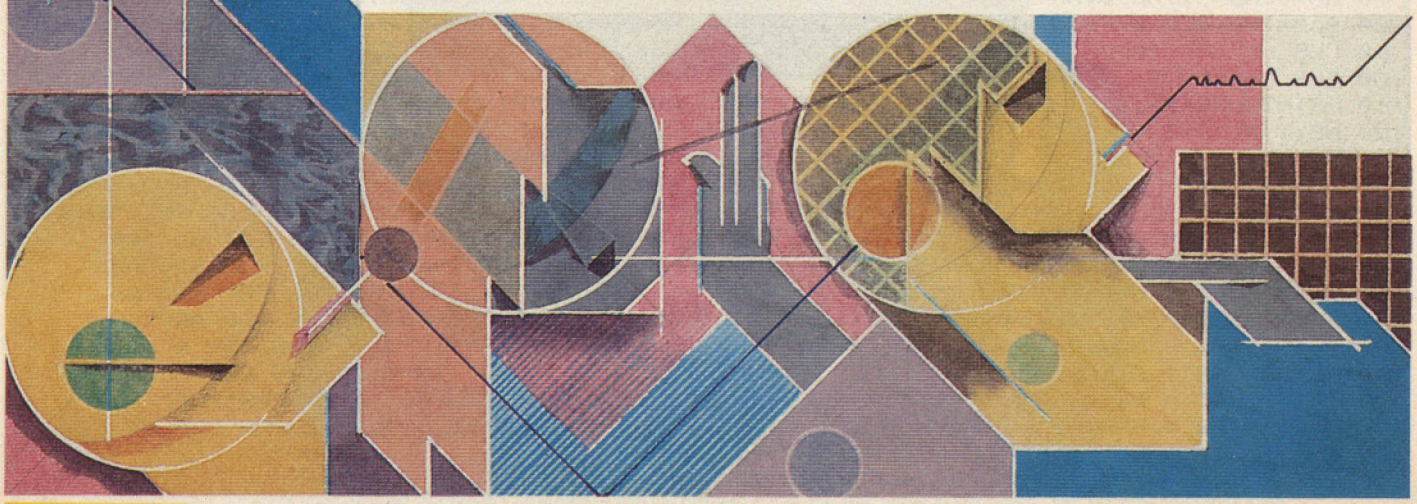
The first of these is Disk Talker, a wholly-based speech add-on costing a paltry $20. The problem is getting hold of it: I haven't seen it advertised in the US, let alone in Britain. Still, it's worth persevering in one's search because it's a most ingenious piece of software.

Booting the Disk Talker disk rewards you with a menu and the spoken message: 'Hi, this is Eric's Talking Disc. Do you want a demo?' Whether or not you take up this offer, sampling your own words is simply a question of plugging in a microphone via a cassette deck and speaking on cue. The words can the be played back, or re-recorded if necessary, and saved onto disk with a relevant filename.

A good deal of data compression is obviously used, as the first part of Eric's message, which last around three seconds, takes up just 17 sectors, or 4.3K. These word files can then be played from within your own Applesoft programs with the following lines, which first load a 4K 'playing' routine, followed by the word/phrase file, and finally, get the Apple talking:

```
100 PRINT D$;'BLOAD PLAY'
110 PRINT D$;'BLOAD <filename>'
120 CALL 2048
```

The disadvantage of this scheme is that it takes time to load the necessary files, but utilities like Hyper DOS and Fast DOS can improve the binary file load time five-fold, which makes gaps between phrases barely



noticeable. Obviously, one can't expect particularly good quality from the Disk Talker software, but, because it sounds human, it's really a darn sight more intelligible than the average phonemic synthesis chip.

Phonemes & Phonetics

With the direct-storage method as a comparison, it's clear that economic speech synthesis needs some means of reducing storage requirements and data output from memory while still retaining intelligibility. One technique that emerged in the mid-1970s was synthesis based on stringing together the basic speech sounds or 'phonemes' common to any language.

The results for phoneme synthesis are the classic examples of talking computers — the IBM computer reciting a Shakespeare sonnet, for example — and this is because of the lack of inflections at the ends of words or sentences and an over-regular cadence to the sound.

This method of speech synthesis produces speech that is generally the least understandable and most robotic of any technique, but it does have the considerable advantage of using minimal memory to store the parameters required to construct a word — 10 bytes per second of speech, on average, compared with the thousands of bytes required by digitization.

Two speech chips specifically designed for phonemic synthesis have made their devious way into the Apple expansion sockets, namely the National Semiconductors Digitalker chip set (speech processor plus ROM holdling phonemes and whole words) and the Votrax SC-01.

An add-on using the former is the speech synthesiser card from Arfon Microelectronics (around £85). Synthesisers using the Votrax chip offer more consumer variety, including the Apple-Vox from Mutek (around £63), the John Bell Speech Synthesiser about $120), and the Type-'N-Talk Speech Synthesiser ($250).

The Votrax chip contains the digitized versions of 64 different phonemes which are accessed by an 8-bit code, with the two MSBs going to set one of four levels of inflection. The Type-'N-Talk system makes life easier than is often the case with these chips by having an internal processor to avoid hogging host processor time, a text-to-speech algorithm for 'instant' translation of ASCII characters into speech, and a 750 character buffer.

Following in a similar vein, there's the Software Automatic Mouth (SAM for short) from Don't Ask Computer Software (for around £90). This more recent entrant into the verbal abuse stakes makes do with just a simple 8-bit DAC for its hardware, but the synthesis is derived from manipulation of phoneme-type elements all the same.

What makes SAM's synthesis better than most is the ability to add as much pitch and speed variation as you think synthetic English can take. Also, the phonetic spelling system seems to offer a considerably closer correlation between expectation and reality.

The interesting point about SAM is that all the synthesis is software-driven, and that should mean one isn't nearly so tied down to the preformed bit codes typical of the average phoneme in the Votrax and Digitalker chips.

Like Eric's Talking Disk, using the SAM from Applesoft is as easy as falling off a log. The following lines, for instance, would be used to store phonetic code in an array and to make the SAM come out with words that the Bard himself might recognise:

```
100 SA$="AY4 AEM AH KUMPYUW3TER."
100 CALL 38128
```

Speed variation (over the range from zero to 255) is simply a matter of a few POKEs in the right places.

One additional utility that's included with the system is Reciter, an English text-to-speech conversion program that lets SAM speak aloud. Perhaps the next Apple show will have Apples en masse performing *Hamlet*? Alas, poor Oric, and all that . . .

LPC

The most recent type of speech synthesis, linear-predictive coding (LPC), offers a happy compromise regarding the amount of memory required for encoding speech, but it's also the first modern technique to return to the principles of vocal tract modelling.

Overall, the vocal tract is a sort of complex sound generator consisting of an amplitude and frequency controlled oscillator (vocal cords and lungs) producing voiced sounds, a noise generator (lungs) producing unvoiced sounds, and a set of filters (mouth and nasal cavities) that shape the sounds into the formants of actual speech.

To synthesise speech, one needs to be able to accurately duplicate the complex interplay between raw sound production and vocal tract filtering, and that's where LPC steps in.

The company that has developed LPC to its current state in the art is Texas Instruments, and its TMS5200 and 5220 chips are, in effect, solid-state models of the vocal tract, with a pulse wave generator in place of vocal cords, a noise source in place of the lungs, and a 12-stage digital filter for all the formant shaping.

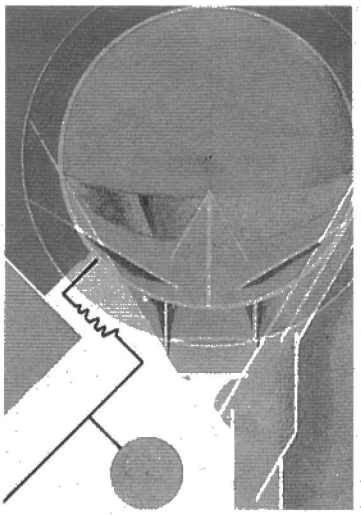
The one Apple add-on that has taken advantage of this new technology is the Echo II Speech Synthesiser from Street Electronics (around £160). Though the current version makes use of a phoneme system for synthesis, it also includes 400 grammatical rules in ROM which do a good job at improving the accuracy of text-to-speech translation.

Like the SAM, the Echo II also permits a huge amount of variety when it comes to intonation. The 5200 chip in this system also has a big advantage over other non-LPC chips in that it permits allophone synthesis, which, to many people, represents the great white hope for speech synthesis on micros.

Also, the phonetic spelling system seems to offer a considerably closer correlation between expectation and reality.

SAM uses 60 phonetic units, which are quite handily noted on a reference card, to produce its sounds. By analysing the words, phrases and sense of what you want your computer to say using the phonetic reference chart and dictionary, you can compound comprehensive structures.

Once data has been encoded phonetically it's then possible to emphasise (using a scale of 0 to 9) each word part by including a digit of appropriate value at correct places in the data.



TALKING SHOPS

Mountain Computer Supertalker — try an Apple dealer who sells the more esoteric sort of add-on.

Eric's Disk Talker — from Programmer International, Inc, 2908 N. Naomi Street, Burbank, CA 91504.

Digitalker — from Arfon Microelectronics Ltd, Cibyn Industrial Estate, Caernarfon, Gwynedd, Wales (tel: 0286 5005).

Apple-Vox — from Mutek, Quarry Hill, Box, Corsham, Wiltshire SN14 9HT (tel: Bath 743289).

John Bell — from John Bell Engineering, 1014 Center Street, San Carlos, CA 94070.

Type-'N-Talk — from Votrax, 500 Stephenson Highway, Troy, MI 48084.

Software Automatic Mouth and Echo II — from Pete & Pam Computers Ltd, New Hall, Hey Road, Rossendale, Lancashire BB4 6JG (tel: 0706 227011).

There's enough around in the way of speech add-ons for the Apple to keep you in business for a while, but contact is the main problem. The table above should help you get together with suppliers.

APPLE SPEECH SYSTEMS

System (Software/ Hardware	Price	Synthesis technique	Use within Basic	Text-to-speech
Supertalker (S/H)	£150	Digitization	Difficult	No
Talking Disk (S)	$20	Digitization	Yes	No
Arfon Digitalker (S/H)	£85	Phonemes/NS chip	Yes	No
Apple-Vox (S/H)	£63	Phonemes/SC-01	Yes	No
John Bell (S/H)	$120	Phonemes/SC-01	Yes	No
Type-'N-Talk (S/H)	$250	Phonemes/SC-01	Yes	Yes
SAM (S/H)	£90	Software synthesis	Yes	Yes
Echo II (S/H)	£160	LPC/TMS5200 chip	Yes	Yes

THROUGH THE SCALES

The TI 9914A has a frequency range of 110 to 44733Hz. This means that you can play notes from A (low) at 110Hz to C at 1674Hz. Notes even higher may be played, but unless you want to serenade a bat, you won't have much use for them. As it is, the TI can play eight ocatave, with seven of them above middle C.

Although the TI can play frequences in steps of 1Hz, there is an accuracy deviation of ± 10 per cent, and although the length of the note may be specified in steps of 1 millisecond, there may be some wavering.

The TI 9914A has a frequency manuals give frequencies only for notes up to the octave A above middle C. Table 1 gives some additional frequencies.

Table 1
Note: Taking C at 32Hz as C0, the TI manuals give octaves A1 to A5. The table gives frequences for A5 to A8.

Note	Frequency (rounded)
A#5	1865
B5	1976
C6	2093
C#6	2217
D6	2349
D#6	2489
E6	2637
F6	2794
F#6	2960
G6	3136
G#6	3322
A6	3520
A#6	3729
B6	3951
C7	4186
C#7	4435
D7	4699
D#7	4978
E7	5274
F7	5588
F#7	5920
G7	6272
G#7	6645
A7	7040
A#7	7459
B7	7909
C8	8372
C#8	8870
D8	9397
D#8	9956
E8	10548
F8	11175
F#8	11839
G8	12544
G#8	13290
A8	14080

TI TALKING ABOUT MUSIC

A micro's sound capabilities, no matter how good they are, are heavily dependent on ease of access. This applies just as much to the TI as it does to any other micro that can produce sound.

The people who will be affected by this are you and I — if you can't use the available facilities easily, there is a good chance you will lose interest.

Texas instruments has seen this problem, and has produced a couple of software command modules to facilitate the use of music/speech on the TI 99/4A. These modules are the Speech Editor and the Music Maker.

The modular approach adopted by TI has advantages and disadvantages. On the good side, you end up buying as you need. For example, if you wish to have speech synthesis, then you must obtain the speech synthesiser which is attached to the expansion socket on the side of the TI.

But to get the speech synthesiser to actually speak, you must obtain the TI Extended basic, the Terminal Emulator II or the Speech Editor. Each of these modules holds the software/hardware modifications necessary to do the desired job — produce speech.

Each software command module has its little quirks — as every piece of software does. You can't expect too much from a limited Basic, and with standard TI Basic, you don't get much. There is a CALL SOUND command at your disposal, but it doesn't always work too well. Enter the following and you'll hear what I mean:

```
10 FOR A=110 TO 1000
20 CALL SOUND(-1,A,1)
30 NEXT A
```

The TI manual tells us that giving a minus value to the duration will start the next tone immediately after the previous. Therefore, you would expect to hear a continuous-toned noise increasing in frequency. But instead the tone 'jumps' as it increases in frequency. If you include a STEP (of 10, say) this should stop *some* of the jumping.

With the Extended Basic, the problem of jumping tones seems to be cured. But all is not well. TI's Basic doesn't really make good use of what is one of the most sophisticated sound chips around. There is no control over the duration of individual sound channels within the same CALL SOUND statement. Also there is no control over the attack and decay of any of the tone or noise channels.

At a lower level, control over the modulation and envelope would have been handy. These problems could be overcome by addressing the sound chip directly, but to do this you would need a great deal of knowledge about the TI, as machine code programming is not possible (so TI says).

Upgrading to the Terminal Emulator II, appears to be the answer. Here we have control over speech synthesis, and it is possible to control the pitch and slope of each word spoken if wished. But using the Terminal Emulator II to produce speech as clear as in the standard TI vocabulary is difficult.

One answer would be to use the vocabulary on the speech synthesiser by using CALL SAY and CALL SPGET. But this cannot be done, as you can't use CALL SAY and CALL SPGET when you are using the Terminal Emulator II.

Sound, Music and Speech

Incorporating sound, music and speech into a program can be a problem. It is possible to produce chords using the sound command with up to three tones, and Table 2 shows the frequencies necessary.

To a degree, it is possible to mix sound (or chords) with speech. This is done by producing the desired tones before the CALL SAY or PRINT speech.

```
10 CALL SOUND (2000, 400, 1)
20 CALL SAY ("HELLOW I AM A COMPUTER")
or
10 OPEN 1: "SPEECH", OUTPUT
20 CALL SOUND (200, 400, 1)
30 PRINT 1: "SOUND AND SPEECH"
```

But can you get the TI to sing and play a tune at the same time? To an extent, yes. The major problem here is adjusting the length of each word spoken. The Terminal Emulator II, allows you to adjust the pitch of the voice and the slope. By slope, I mean the rate at which the pitch is adjusted in the word. It seems that you cannot get the synthesiser to 'streatch' a word.

If you have a TI and Emulator II, try entering the following:

```
DOEEEEE; RAAAYEEEE; FARRRRRR.
```

Instead of getting a nice continous word as we would wish, each letter at the near end of the words is almost spelled out.

It might be possible to obtain prolonged words by stringing together different allophones, but even though this method is theorectically possible, it would be very tedious. It is possible (or near enough,) to get the speech synthesisers and the Terminal Emulator II to speak in tune with whatever noise or notes you are playing. To do this it is first necessary to get the correct pitch to the tone.

Here is a program that does that. Note when you think you have a pitch and slope that matches with the tone, write down for future reference:

```
110 OPEN 1: "SPEECH", OUTPUT
120 CALL CLEAR
130 PRINT " ENTER PITCH FOR WORD"
140 INPUT P
150 PRINT "ENTER SLOPE FOR WORD"
160 INPUT S
170 LET W$= "//" &" " STR$ (S)
180 PRINT# : W$
190 "ENTER FREQUENCY OF TONE"
200 INPUT F
210 PRINT "ENTER WORD"
220 INPUT W$
230 CALL SOUND (1000,F,1)
240 PRINT#1: W$
250 GOTO 120
```

```
100 CALL CLEAR
110 REM SPELL CHECK
120 CALL SAY("DO YOU WANT TO TRY AND SPELL SOME WORDS")
130 PRINT "DO YOU WANT TO TRY AND SPELL SOME WORDS"
140 CALL SAY("PLEASE ENTER Y OR N")
150 PRINT "PLEASE ENTER Y OR N"
160 INPUT A$
170 IF A$<>"Y" AND A$<>"N" THEN GOTO 140
180  IF A$="N" THEN PRINT "VERY WELL THEN" :: CALL SAY("SO YOU GIVE UP
THEN") :: CALL SAY("#I WIN#") :: GOTO 290
190  IF  A$="Y" THEN PRINT "O.K. HERE WE GO" :: CALL SAY("O K HERE  WE
GO")
200  PRINT "TYPE IN THE CORRECT SPELLING OF THE WORD YOU'D LIKE TO  BE
TESTED ON"
210 INPUT A$
220 CALL CLEAR
230  PRINT "NOW LET'S SEE IF YOU CAN REMEMBER HOW TO SPELL THAT  WORD.
LISTEN CAREFULLY AND I'LL TELL YOU WHAT THE WORD IS"
240 CALL SAY("HOW TO YOU SPELL") :: CALL SAY(A$)
250 PRINT "WHAT'S YOUR GUESS"
260 INPUT Q$
270  IF  Q$<>A$ THEN CALL SAY("#THAT IS INCORRECT#") :: CALL  SAY("TRY
AGAIN") :: PRINT "HAVE ANOTHER GO" :: GOTO 240
280 IF Q$=A$ THEN CALL SAY("#THAT IS RIGHT#") :: GOTO 120
290 CALL SAY("GOOD BYE") :: PRINT "GOODBYE" :: CALL CLEAR :: END
```

SPEECH AND SPELL

This program will let you input words from the TI Speech Synthesiser's vocabulary (partially listed below), then clears the screen and asks you (in a male voice with an American accent) how to spell that word.

It will prompt you for the right answer until you spell the word correctly and then give you a chance to spell another word. Here's a brief breakdown of how the program works:

Lines 110-160 — These lines clear the screen, then generate a voice which asks whether or not you want to start spelling.

Lines 170-190 — The program now tests whether you want to continue and takes the appropriate action.

Lines 200-220 — These lines ask for the words you want to spell.

Lines 230/280 — the last section of the program gets your spelling guesses and checks them against the original word you entered.

Line 290 — This is the program line which exits the program when you're finished spelling.

A WORD ON VOCABULARY

Some of the words in the resident vocabulary have more than one pronunciation. In those cases, the word is listed twice in the manual with a "1" after the second listing. Each pronunciation is provided in parentheses after the word. When using one of these words, you must distinguish between them by including the "1" with the second listing if that is the pronounciation required.

A(a)
A1(e)
ABOUT
AFTER
AGAIN
ANSWER
ASSUME
BACK
BASE
BETWEEN
BLACK
BLUE
BOTH
BOTTOM
CASSETTE
CENTRE
CHECK
CHOICE
CLEAR
COLOR
COME
COMES
COMMA
COMMAND
COMPLETE
COMPLETED
COMPUTER
CONNECTED
CONSOLE
CORRECT
COURSE
CYAN
DATA
DECIDE
DEVICE
DIFFERENT
DISKETTE
DOING
DONE
DOUBLE
DOWN
DRAW
DRAWING
EIGHT
EIGHTY
ELEVEN
ENTER
ERROR
EXCTLY
EYE
FIFTEEN
FIFTY
FIGURE
FIND
FINE
FINISH
FINISHED
FIRST
FIVE
FOR
FOURTY
FOUR
FOURTEEN
FRONT
GAMES
GETTING
GOING
GOOD
GOODBYE
GRAY
GREEN
GUESS
HAVE
HEAD
HIGHER
HOME
HOW
HUNDRED
HURRY
INSTRUCTION
JOYSTICK
KEYBOARD
KNOW
LARGE
LARGER
LARGEST
LEARN
LIKES
LOAD
LOOKS
LOWER
MAGENTA
MEMORY
MESSAGES
MIDDLE
MIGHT
MODULE
NEGATIVE
NINE
NINETY
NUMBER
ORDER
OTHER
PARTNER
PARTS
PERIOD
PLAYS
PLEASE
POINT
POSITION
POSITIVE
PRINTER
PROBLEMS
PROGRAM
PUTTING
RANDOMLY
READ (rēd)
READ (rĕd)
RECORDER
RED
REFER
REMEMBER
RETURN
REWIND
RIGHT
SAYS
SCREEN
SECOND
SEVEN
SEVENTY
SHAPE
SHAPES
SHIFT
SHORT
SHORTER
SHOULD
SIDES
SIXTY
SMALL
SMALLER
SMALLEST
SOME
SORRY
SPACES
SPELL
SQUARE
START
STEP
SUPPOSED
SURE
TAKE
TEEN
TELL
THAN
THAT
THEIR
THERE
THESE
THEY
THINGS
THINK
THIRD
THIRTEEN
THIRTY
THIS
THREE
THREW
THROUGH
TIME
TONE
TOO
TOP
TRY
TURN
TWELVE
TWENTY
TWO
TYPE
UNDERSTAND
UNTIL
VARY
VERY
WAIT
WANTS
WEIGHT
WELL
WHAT
WHEN
WHERE
WHICH
WHITE
WHO
WHY
WILL
WORDS
WORKING
YELLOW
YES
YOUR
ZERO

TONES TO BOOST THE ATARI

Adding sound to any graphic display makes it more interesting. Sound can be used to keep you entertained while a graph or picture is being drawn. Any task that takes a long time to complete can be made less boring by adding sound (for instance, music playing while a program or data is being loaded from the cassette). The most obvious mixing of sound and graphics occurs in games. Avid Defender players should recognise the sound produced by the statements in Program 1.

Atari Basic does not include a duration variable within its SOUND statement although the Atari Microsoft Basic II ROM cartridge does. Once a sound voice is implemented it continues to play until it is either changed or switched off. This has it's advantages and disadvantages but gives you less to worry about when producing sound effects in Games.

Nearly all of the games on the Atari include sound of two major types, sound effects and music. Sound effects are the easiest, as timing is not so crucial. An explosion after a collision will not sound very different if it is half a second longer than planned. Music however can become very distorted if it is not timed properly.

To the Basic programmer mixing sound and graphics can be a little tricky. The first demonstration program gives an example of co-ordinating sound with a graphic display. The easiest way to add sound is to include a SOUND command with each PLOT command and use the same variables for both:

```
FOR X=1 TO 20:PLOT 10,X:SOUND 0,10*X,10,10:
  NEXT X
```

This will normally give a pretty random piece of music but it will be less boring than just the display itself. Try taking the SOUND statements and their related commands out of the first demonstration program (Program 1) and see what a difference it makes.

So how do machine-code programmers time the music in their games so well? The most common method is to utilise Vertical Blank Interrupts. When a television draws a screen it starts in the top-left corner, draws a line to the right-hand side of the screen, switches off the beam, moves down one line while travelling to the left side of the screen again and then draws another line. This continues until the beam reaches the bottom-right corner of the screen then switches off and travels back to the top-left of the screen again. This final journey happens at a regular interval and is called the vertical blank.

If required, the computer can give you some time during this 'flyback' by using an interrupt. Although this time is very short, it is enough time for the machine-code programmer to carry out a number of commands, such as changing the sound registers. This is how some of the top games on the Atari include music in the program.

As most games on the Atari are written in machine code, the sound registers have to be controlled directly. This requires a little more programming than the Basic SOUND command but a much wider range of sounds can be obtained.

The game Preppie plays music as well as game sound effects through-out the game. The music is 'enveloped', a process by which the computer sound is controlled to produce sound similar to that obtained from musical instruments.

Of course, games are not the only application of mixing sound and graphics. My First Alphabet by Atari plays the Alphabet song while simultaneously displaying the corresponding letters. And you can learn a language using one of the conversational language courses by Atari, where voices are taken from the recorder and synchronised with a picture and text on the screen.

Program 1.

This program asks you to type in your name and then it will draw a series of boxes increasing in size, leading up to your name, with sound effects.

Line 10 Clears the screen and DIMensions a string to take the name.

Line 40 Sets up graphics 7 without a text window (7+16) selects colour 1 and initialises variables used to determine the positioning and size of the boxes.

Lines 50-100 Draw the boxes moving them across the screen by altering the control variables while line 60 produces the sound using the same value as the position variable (X).

Lines 120-150 Provide the sound for the final display of the name and displays the name.

```
1 REM ** GRAPHIC/SOUND COMBINATION **
2 REM ** FROM THE SILICA ATARI U.C.**
3 REM **** ADAPTED BY R.A. HAWES ****
10 ? CHR$(125):DIM A$(15)
20 POSITION 5,11:PRINT "WHAT IS YOUR NAME ";
30 INPUT A$
40 GRAPHICS 7+16:COLOR 1:Z=2:Y=5:X=155
50 PLOT X,Y
60 X=X+2*Z:SOUND 0,X,14,8
70 DRAWTO X,Y:Z=Z-(2*Z):Y=Y+Z
80 DRAWTO X,Y
90 IF Z>0 THEN Z=Z+2
100 Z=Z-3
110 IF Y<70 THEN 50
120 FOR DD=1 TO 100:SOUND 3,DD,6,10
130 GRAPHICS 2+16:POSITION 3,8:PRINT #6;"HELLO,
 ";A$:NEXT DD
140 FOR XYZ=1 TO 20:NEXT XYZ
150 SOUND 0,0,0,0:SOUND 3,0,0,0:GOTO 20
```

```
PROGRAM2
1 REM ** GRAPHIC/SOUND COMBINATION **
2 REM ** FROM THE SILICA ATARI U.C.**
3 REM **** ADAPTED BY R.A. HAWES ****
5 GRAPHICS 0
7 ? :? :? :? :POKE 18,0:POKE 19,0:POKE 20,0
10 DEG :GOSUB 100:GRAPHICS 9:GOSUB 110:C=1
20 P=RND(1)*5:CP=RND(1)*0.5:A=(RND(1)*95):
CA=RND(1)*10:COLOR C
30 FOR X=0 TO 79:Y=SIN(X*P)*A:N3=N2:N2=N1:
N1=N0:N0=ABS(Y*1.5):SOUND 0,N0,10,11:S
OUND 1,N1,10,9:SOUND 2,N2,10,7
40 SOUND 3,N3,10,5:PLOT X,96+Y:DRAWTO X,96-Y
50 P=P+CP:IF ABS(P)>5 THEN CP=-CP
60 A=A+CA:IF ABS(A)>95 THEN CA=-CA:GOTO 60
70 NEXT X
80 C=C+1:IF C>15 THEN C=0
90 GOTO 20
100 ? "WHAT DO YOU WISH FOR THE BACKGROUND
COLOUR ";:INPUT C
105 RETURN
110 SETCOLOR 2,C,4:SETCOLOR 4,C,4
120 RETURN
```

Program 2.

This program draws sine-type waves on the screen while using sound corresponding to the lengths of the lines used.

Line 7 Moves the cursor down the screen and resets the timing registers (18, 19 and 20).

Line 10 Makes the computer calculate in degrees instead of the normal radians, goes to the routine that gets the background colour, selects GTIA mode 9 and initialises a counting variable C.

Lines 20-40 Displays a random curve generated through the use of the sine function while giving a sound corresponding to the display.

Lines 50-60 set the upper and lower limits of the curve.

Line 70 sends the program back around the loop until the curve reaches the end of the screen.

Line 80 increments the shade of the chosen colour.

Program 3.

This program displays random symettrical patterns on thescreen while also playing a random tune.

Line 10 Initialises graphic 7 without a text window.

Line 30 Ensures that the machine will not go into 'attract' mode.

Line 40 Sets up two loops, one selects colour and the other sets the number of times the program will run.

Lines 60-70 Determine the point to be plotted.

Line 80 Decides whether to go to 20 or 90 to decide whether or not to plot the four symetrical points.

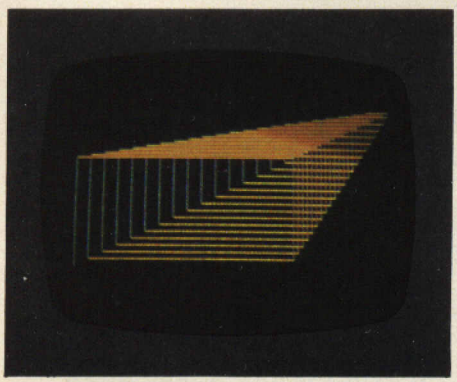
Lines 90-120 Plots the calculated points in a symetrical pattern.

Lines 130-140 Sets the colours of the points.

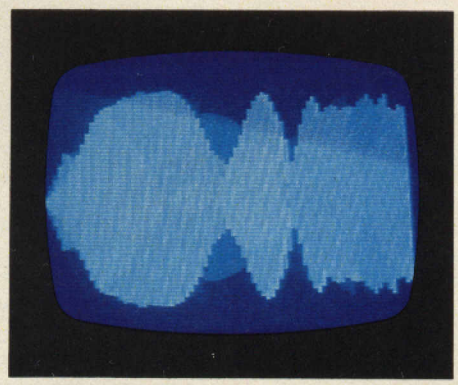
Lines 150-160 Produce the Sound effects.

Line 170 Completes the program

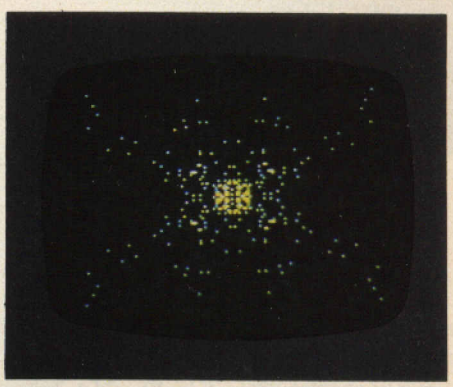
```
PROGRAM3
1 REM ** GRAPHIC/SOUND COMBINATION **
2 REM ** FROM THE SILICA ATARI U.C.**
3 REM **** ADAPTED BY R.A. HAWES ****
10 GRAPHICS 23
20 X=0:Y=0
30 POKE 77,0
40 FOR A=1 TO 30:FOR C=1 TO 3
50 COLOR C
60 X=X+INT(RND(1)*15)-7
70 Y=Y+INT(RND(1)*15)-7
80 GOTO 20+70*(X>=0)*(X<80)*(Y>=0)*(Y<48)
90 PLOT 80+X,48+Y
100 PLOT 80+X,48-Y
110 PLOT 80-X,48+Y
120 PLOT 80-X,48-Y
130 SETCOLOR C-1,0,RND(1)*256
140 SETCOLOR 1+(C=1)-(C=2),0,0
150 SOUND 1,X,10,15
160 SOUND 2,Y,12,15
170 NEXT C:NEXT A
180 GOTO 10
```



The screen shows the series of boxes that is built up with Program 1. Immediately after you see this, your name will appear.



The random interlacing of patterns produced in Program 2. The eerie sounds produced change in time with the on-screen shapes.



Program 3 accomplishes much the same as Program 2 but the net result is a more complex pattern and even odder sounds.

DRAGON DIVERSION

We've looked at the ins and outs of the Dragon's sound capabilities, so now it's time to demonstrate how you can use these techniques in a full program.

In this game, called Scrumping, you and Derek Dragon work together to whip the apples off the trees, over the orchard wall and into your basket. Using the right joystick, you have to catch the booty which Derek throws over the wall, scoring points as you go. As you hoard mounts, so does your confidence and the height of your plank, making the game harder. If you drop ten apples, Derek gives up and slopes off in disgust.

The program uses hi-resolution colour graphics and much sound. Two speeds are offered, but if your Dragon cannot handle the high speed poke (POKE 65495,Ø) and crashes, then use slow speed. Scrumping could easily have been written in machine code, but Dragon Basic is more than fast enough, and provides an easy-to-follow listing.

At the end of a game, your score, time and rating is displayed. If you break off during the game and make no entries, the computer goes into demonstration mode and plays itself. Pressing any key will break out of this.

The small machine code routines in lines 60 to 80 are used to scroll the hi-res display. Lines 100-280 DRAW and GET the graphics characters — apples, basket and numerals 0 to 9. The game section of the program should be easy to follow, but here's a description of the sound generation statements used:

1210	Plays a well-known piece of music with the title page.
440	Start of game sound.
540	Catch apple sound.
580 to 660	Sound effect of apple crushing on plank.
700/710	Game over music.
990	Move up to next level sound effect.

The other sound commands used are general whoops and beeps. This program demonstrates how graphics and sound can be used together . . . try turning the volume off and playing the game and you will notice what a difference sound makes.

Contributors: Brian Cadge, David Ellis, Richard Hawes, David Janda, Martin Phillips and Geof Wheelwright
Design: Nigel Wingrove
Illustrators: Will Hill, Shirley Barker

NEXT WEEK

We begin a two-part series on the CP/M operating system, including its history the people involved in developing it, its strengths and weaknesses and more.

In two weeks time the CP/M series continues with a look at how the machine interfaces with CP/M, what front-ends are available and how it compares with other systems such as MS-DOS.

```
10 '*****************************
20 '*******  SCRUMPING  *******
30 '*****************************
40 '
50 CLS0:SCREEN0,0
60 CLEAR1000,32699:FORI=1TO14:READA$:POKE 32749+I,VAL("&H"+A$):NEXT:DATA 8E,6,0,
EC,88,20,ED,81,8C,11,E0,26,F6,39
70 DEF USR0=32750
80 FORI=1TO14:READA$:POKE 32699+I,VAL("&H"+A$):NEXT:DATA 8E,6,20,EC,88,40,ED,81,
8C,1D,A0,26,F6,39
90 GOSUB1120
100 PMODE1,1:COLOR1,2:PCLS
110 DIMN$(10):N$(0)="R8U12L8D12":N$(1)="BR8U12":N$(2)="NR8U6R3U6L8":N$(3)="R8U6N
L6U6L8":N$(4)="BR8U12D6L8U6":N$(5)="R8U6L8U6R8":N$(6)="XN$(5)+L8D12":N$(7)="BR8U
12L8":N$(8)="XN$(0)+U6R8":N$(9)="R8U12L8D6R8":N$(10)="NU12BR4XN$(0)+"
120 R$(0)="BR4U12NL4R4BR4NR8D6NR6D6R8;BR4U12R8D6L8R2F6;BR4U12R8D6L8R2F6;BR4NU12;
BR4U12R6F2D2G2NL6F2D2G2L6BR8;BR4NU12R8BR4;NR8U6NR6U6R8"
130 R$(1)="U12D2F8D2NU12;BR4U12R8D12NL8;BR4BU12D8F4E4U8BR4;D12BR4;NR8U12R8;BR4NR
8D6NR6D6R8"
140 R$(2)=LEFT$(R$(1),29)+"BR8U12NL4R4BR12;ND12R6F2D2G2NL6F2D2G2L6;BR12U12R8D6NL
8D6BR4;U12R6F2D8G2L6"
150 R$(3)="U12NR8D12R9U6L4BR8BD6;U12R8D12NL8;BR4U12R8D12NL8BR4;U12R6F2D8G2L6"+R$
(4)+"BU12D8F4E4U8BR4;NR8D6NR6D6R8BR4;U12R8D6L8R2F6BR8;UE4U2BL8D2F4BR18BD6;"+R$(
3)+R$(5)+"NR8U6NR6U6R8BR4;D2F8D2BL8U2E8U2BR4;ND12R8D6L8BD6BR12;NR8U6NR6U6R8;BR4N
D12R8D6L8R2F6
160 DRAW "C8M5,0;D5F1R15E1NU5G2;L3NF6L7NG6;BM5,2;R15":PAINT(8,4),3,3
170 R$(5)=R$(5)+"BR8U12NL4R4"
180 DIM A(0,7):GET(0,0)-(27,13),A,G
190 PCLS2:DRAW "C1BM4,7;R3F3D3G3L3H3U3E3;U1H1C4H1BR6R1":PAINT(5,10),1,1
200 DIM B(0,7):GET(0,0)-(11,17),B,G
210 PCLS2:DRAW"C1BM4,7R3F3D1G3L3H3U1E3U1H1C4H1BR6R1":PAINT(6,8),1,1
220 DIM C(0,7):GET(0,0)-(11,15),C,G:PCLS2
230 DRAW "C1BM4,7R3F3D1G1L7H1U1E3U1H1C4H1BR6R1":PAINT(6,10),1,1
240 DIM D(0,7):GET(0,0)-(11,13),D,G:PCLS2
250 DRAW "C1BM4,9R3F2L7G2NR11E2E2U1H1C4H1BR6R1"
260 DIM E(0,7):GET(0,0)-(11,13),E,G:PCLS2
270 DRAW "C1BM0,13R11L5U2C4U1L2"
280 DIM F(0,7):GET(0,0)-(11,13),F,G
290 PCLS2
300 IF AU<>0 THEN CLS0:PRINT@387,"computer"+CHR$(128)+"will"+CHR$(128)+"demons$tr
ate";:SCREEN0,1:PLAY "L80T20V31CDEFGAB":IN=0:FORT=1TO3000:NEXT:GOTO 310
310 SCREEN1,0
320 CLS
330 COLOR3:LINE(0,0)-(255,30),PSET,BF:COLOR4:LINE(0,32)-(255,34),PSET,BF
340 LINE(0,184)-(255,191),PSET,BF:COLOR1:LINE(0,182)-(255,182),PSET
350 DRAW "C2BM30,20U12R8D6NL8D6BR4U12R8D6NL8D6BR4;U12R8D6NL8D6BR4;NU12R8BR4;NR
8U6NR6U6R8;BR4NR8D6R8D6L8;BR20U12R4F4D4G4L4BR12U12R8D6L8R2F6BR4U12R8D12NL8BR4U12
R8D6NL8BR4ND6U6R3D6NL8BR4BD6NR8U6NR6U6R8BR4R4F4D4G4L4U12;BR16BD4D1BD3D1;BM206,20
;XN$(0);"
360 COLOR1:X=2:FOR Y=0 TO 191 STEP2
370 X=X+Z:IF X<0 THEN X=0 ELSE IF X>50 THEN X=50
380 Z=RND(7)-4:IF Z=0 THEN 380
390 LINE(0,Y)-(X,Y),PSET:LINE(255,Y)-(255-X,Y),PSET
400 NEXT
410 FOR K=0 TO 4:LE(K)=5+RND(4+K):NEXT:AF=0
420 'start of game
430 AP=0:AD=0:L=0:GOSUB980:X=XM+6
440 PLAY"L4V2902T50CDEFGEFGABFGAB0+CDEDEFGG"
450 TIMER=0
460 AX=RND(150)+50
470 IF AF>0 AND FL=0 AND L<4 AND AF/LE(L)=INT(AF/LE(L)) THEN L=L+1:GOSUB980:FL=1
:AF=0
480 FOR AY=36 TO Y-19 STEP 4
490 PUT(AX,AY)-(AX+11,AY+17),B,PSET
500 IF AU=0 THEN J=JOYSTK(0):X=X+(J<13)*4-(J>50)*4 ELSE X=X+(X>AX-6)*4-(X<AX-10)
*4
510 IF AU<>0 AND (PEEK(65280)OR128)<>255 THEN RUN
520 IF X>XM THEN X=XM ELSE IF X<XL THEN X=XL
530 PUT(X,Y1)-(X+27,Y1+13),A,PSET
540 IF AY+17>Y1-2 AND AY+17<Y1+4 AND X<AX AND X>AX-16 THEN AF=AF+1:PLAY"V31O1T9
0AA":AF=AF+1:COLOR2:LINE(AX,AY)-(AX+11,AY+17),PSET,BF:FL=0:GOTO460
550 NEXT
560 AD=AD+1:AY=Y-15
570 PUT(AX,AY-2)-(AX+11,AY+13),C,PSET
580 PLAY "V31O3T80BAGFED"
590 PUT(AX,AY)-(AX+11,AY+13),D,PSET
600 PLAY "V25EDCO2BAGF"
610 PUT(AX,AY)-(AX+11,AY+13),E,PSET
620 PLAY "V16FEDCO1BAGF"
630 PUT(AX,AY)-(AX+11,AY+13),F,PSET
640 PLAY "V13GFF#EDC"
650 COLOR2:LINE(AX,AY)-(AX+11,AY+13),PSET,BF
660 PLAY "V5FEDC"
670 DRAW "C3BM206,20"+N$(AD-1)+"C2BM206,20"+N$(AD)
680 IF AD<10 THEN 460
690 PUT(X,Y1)-(X+27,Y1+13),A,PSET
700 PLAY"L4V3104T40BAGFEDCO3BAGFEDCO2BAGFEDCO1BAGFEDC"
710 PLAY "P1V31T50IL4CDEP10CL8GGGFFEEEDDDLGC"
720 COLOR3:LINE(0,191)-(255,191),PSET:FORL=0 TO 99:DU=USR0(0):NEXT
730 T=INT(TIMER/50)
740 COLOR2:LINE(0,0)-(255,191),PSET,B
750 CO=1:FOR TI=1 TO 40
760 DRAW "S6C"+STR$(CO)+"BM20,50R8U6L8U6R8;BR4NR8D12R8;BR4U12R8D12NL8;BR4U12R8D6
L8R2F6;BR4NR8U6NR6U6R8;BR8BD4NR8BD4NR8;BD4BR14;"
770 S1=INT(AP/10):S2=AP-S1*10:DRAW "XN$(S1);BM156,50;XN$(S2);"
800 DRAW "XN$(S1);BM156,98;XN$(S2);BM178,98;XN$(S3);"
810 IF AU<>0 THEN 900
820 DRAW "S4BM20,130;U12R8D6L8R2F6;BR4U12R8D6NL8D6;BR8U12NL4R4;BR4D12;BR4U12D2F8
D2U12;BR4NR8D12R8U6L4;BR12BU2ND1BD4ND1;BR16;BD4"
830 IF AP<8 THEN RA=0
840 IF AP>=8 AND AP<15 THEN RA=1
850 IF AP>=15 AND AP<22 THEN RA=2
860 IF AP>=22 AND AP<26 THEN RA=3
870 IF AP>=26 AND AP<30 THEN RA=4
880 IF AP>=30 THEN RA=5
890 DRAW R$(RA)
900 DRAW "S4BM50,180;U12R8D6NL8D6;BR4U12D2FSD2NU12;BR4U12R8D12NL8;BR8U12NL4R4BR4
D6ND6R8NU6D6;BR4NR8U6NR6U6R8;BR4ND12R8D6L8R2F6;BR12;U12NR8D12R8U6L4;BR8BD6;U12R8
D6NL8D6;BR4U12R4ND6R4D12;BR4NR8U6NR6U6R8;BR8D2E2R4F2D2G4BD4D1"
910 IF CO=2 THEN CO=1 ELSE CO=2
920 I$=INKEY$
930 IF I$="Y" THEN GOSUB970:AU=0:GOTO220
940 IF I$<>"N" THEN NEXT TI:AU=1:GOSUB970:GOTO220
950 POKE 65494,0
960 PRINT:PRINT"GOOD-BYE!":END
970 COLOR2:LINE(0,191)-(255,191),PSET:FORL=1TO100:DU=USR0(0):NEXTL:RETURN
980 'set up plank
990 IF L>0 THEN SCREEN1,1:PUT(X,Y1)-(X+27,Y1+13),A,PSET:PLAY"L4V01T200:CDEFGABC2
CDEFGABC3CDEFGAB":SCREEN1,0:COLOR2:LINE(X,Y1)-(X+27,Y1+13),PSET,BF
1000 Y=191-(20+L*26)
1010 FOR F=0 TO 80:IF PPOINT(F,Y)=1 THEN NEXT
1020 XM=F+1:FOR F=255 TO 180 STEP-1
1030 IF PPOINT(F,Y)=1 THEN NEXT
1040 XL=F-1
1050 COLOR4:LINE(XM,Y)-(XL,Y),PSET
1060 XL=XL-35:XM=XM+15
1070 DRAW "C4BM"+STR$(XM)+","+STR$(Y)+"NF10NG10;BM"+STR$(XL+20)+","+STR$(Y)+"NF1
0NE10"
1080 IF L=0 THEN 1100
1090 COLOR1:LINE(0,Y+12)-(255,Y+12),PSET:PAINT(128,Y+10),4,1:COLOR4
1100 Y1=Y-15
1110 RETURN
1120 'INSTRUCTIONS
1130 PMODE3,1:COLOR2,3:PCLS
1140 DR$="R8U6L8U6R8;BR4NR8D12R8;BR4U12R8D6L8R2F6;BR4NU12R8NU12;BR4U12R4ND6R4D12
;BR4U12R8D6NL8BD6;BR4NU12;BR4U12D2F8D2U12;BR4NR8D12R8U6L4"
1150 AK$="NL6NR6ND6NU6NE6NF6NG6NH6"
1160 LINE(0,0)-(255,191),PSET,B
1170 DRAW "S8BM30,120;XDR$;"
1180 FOR X=30 TO 230 STEP 16:DRAW "S3BM"+STR$(X)+",137"+AK$:NEXT
1190 SCREEN1,0
1200 POKE 65494,0
1210 PL$="V2501T6L4DGDGAL2BL4AL8BO+CL4DO-GL8BAGF#L2.G;P64;":PLAY PL$+PL$+"L8BO+C
L4.DL8EL4DCO-GL4.BO+GBCL4DO-GO+GL4.EL8EDCO-BAL2GL4F#LBDDL4GDGAL2BL4AL8BO+CL4DO-GL8
BAGF#L2.G"
1220 FORL=1 TO 40:EXEC 32700:NEXT
1230 D1$="U6NR6U6R8;BR4ND12R8D6NL8D6;BR4R8U6L8U6R8;BR4R8L4D12BR4;BR12U12R8D12NL8
;BR4U12R8D6L8R2F6;BR12R8U6L8U6R8;BR4D12R8;BR4U12R8D12NL8;BR4NU12R4NU6R4U12;BR12B
D2E2R4F2D2G4BD3D1"
1240 DRAW "BM50,100S4;XD1$;"
1250 PLAY "T50O1CDEFG"
1260 I$=INKEY$:IF I$<>"S" AND I$<>"F" THEN 1260
1270 IF I$="S" THEN POKE 65494,0
1280 IF I$="F" THEN POKE 65495,0
1290 LINE(48,80)-(210,102),PRESET,BF
1300 D1$="NR8U12R8;BR4ND12R8D12NL8;BR4U12R4ND6R4D12;BR4U12R8D6NL8BD6;BR4NU12R8U1
2;BR4R8L4D12;BR8NR8U6NR6U6R8;BR4ND12R8D6L8R2F6;BR12U12R4F4D5G4L4BR8;BR4NR8U6NR6U
6R8;BR4ND12R4ND6R4D12;BR4U12R8D12NL8;BR16U6H4U2BR8D2G4D6;BR8E12;BR4ND12D2F8D2U12
;BR12BD2E2R4F2"
1310 D1$=D1$+"D2G4BD3D1"
1320 DRAW "BM20,100;S4XD1$;"
1330 PLAY "O1CDEFGAB"
1340 I$=INKEY$:IF I$<>"Y" AND I$<>"N" THEN 1340
1350 IF I$="Y" THEN AU=1 ELSE AU=0
1360 FORL=1TO60:EXEC32700:NEXT
1370 PCLS3:CLS0:SCREEN0,0
1380 RETURN
```

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which would take up too much of the base-processor's time can be handled by on-module micro-processors, which would do as much as was practical.

Intermediate results would be processed independently, either in the module itself, or by another module, which in this case would probably be a pure processor, operating in parallel on another bus. In either case, the last processor in line would then transfer the final result to the base-machine, which would store it on the disk.

Operation

The rationale for the X-1 is its operation, and this is where the philosophy is most clearly exemplified. In essence the X-1 is a kind of hyperthyroid 'state-machine'. It only exists to change from one state to another, the doing of which will produce some kind of result.

When a state involves a device which is comprehensible by the user (such as a screen or printer), output is obtained, and if the previous changes involve a state which is interpretable by the user, then useful output is produced.

Notice that at no stage was any assumption made as to what is, and what is not, correct. This is avoided so data may be handled in any way which may seem appropriate to the user. The X-1 isn't going to presume to tell him that what he's doing doesn't make sense. But that doesn't mean that it can't try to guide him, tell him what he's got and how he got it, let him undo it, returning to a prior state, and generally assist.

The principal operation for the X-1 can be stated as 'Record any changes that have occurred'. If that were carried to its logical conclusion it would mean recording *every* data-movement, no matter how small. But no matter how much storage was available, it would be full in seconds, even with a small, slow machine.

Fortunately, there's a method of doing what amounts to exactly the same thing, and doing it in a practical fashion, meaning in a reasonable space. Since the only changes that matter are the ones which actually 'hit the outside' so to speak, all we have to do is to record *them*. We can afford to forget the actual ones which produced the second state from the first. Obviously, this will consume much less space.

The basic idea is as follows: The only thing which *must* be known in order to process some data is the 'shape' of the data before processing, and the shape afterwards. Further, the operations needed to make the desired change only form another set of data!

In practical application, this means that provided the machine is given a picture of the data which bears a reasonable relationship to the situation, then there is no possibility of an incorrect program.

That's a pretty tall claim to make, so I'll add the caveat that this also means that all output, no matter how useless, is correct, since it is no more than a set of data, processed exactly as instructed. The user alone is responsible for deciding whether that output means anything.

If this sounds like a very circular argument, let me explain that the X-1 is provided with tools which will (hopefully) reduce the need for the user to try interpreting his perfectly correct output, by eliminating the chance that he will give an incorrect set of instructions, and so won't produce any garbage.

This is accomplished by means of a kind of 'super-interpreter', like Occam. Any changes which are made to the current state are immediately shown, the effect is shown, and the command which caused the change is recorded, as well as the former state of the effected item.

Since the result is immediately apparent, there is less chance of progressing far down a wrong path, and even if this happens it isn't much problem, since each change can be undone in order, allowing the user to backstep. When the data has been successfully changed to the desired state, the entire sequence of necessary operations has been performed and recorded. A process has been 'nailed down'.

To reactivate the process, it is only necessary to order the computer to use that data-set as a set of instructions. Of course, since the instructions are only data as far as the machine is concerned, they too can be operated on as data!

'So how would you actually make a change to the new data. Or come to that, how would you input new data-shapes?

The odd thing is that it doesn't matter! You could use a keyboard with some kind of interpreter, a light-pen and the keyboard combined, or even (if we're being really trendy) a mouse. In extreme cases you could even use voice-input, remote-control over the phone, or any other method which seemed appropriate.

The point is that the actual details, just like for output, are implied by the change required and the device in use. The machine can take care of the trivialities.

Since the only data we are really interested in is either input or output, and so long as the internal records can be suitably converted before becoming output, the only thing you would have to do is to describe the data to the machine using whatever device is currently active.

This is what regular programming is all about. But as we know, it doesn't work very well, so on the X-1 the data — or at least a representation of it — is always in view in the form of a screen display.

Producing a display is not just a simple matter of writing stuff on the screen, but a complex task, a lot of which is concerned with making suitable changes, as well as making suitable adjustments so that the layout is aesthetically pleasing. The changes to the data have to be made so that it'll mean something to the viewer, and the adjustments so that it can be read. It doesn't take long to realise that much of this will be common to any device, so it would make sense to have just one copy of the routines.

Whenever a routine is needed, it can be activated, used and restored to its former state without interfering with any other process which may be using it. If each common detail is reduced to a single

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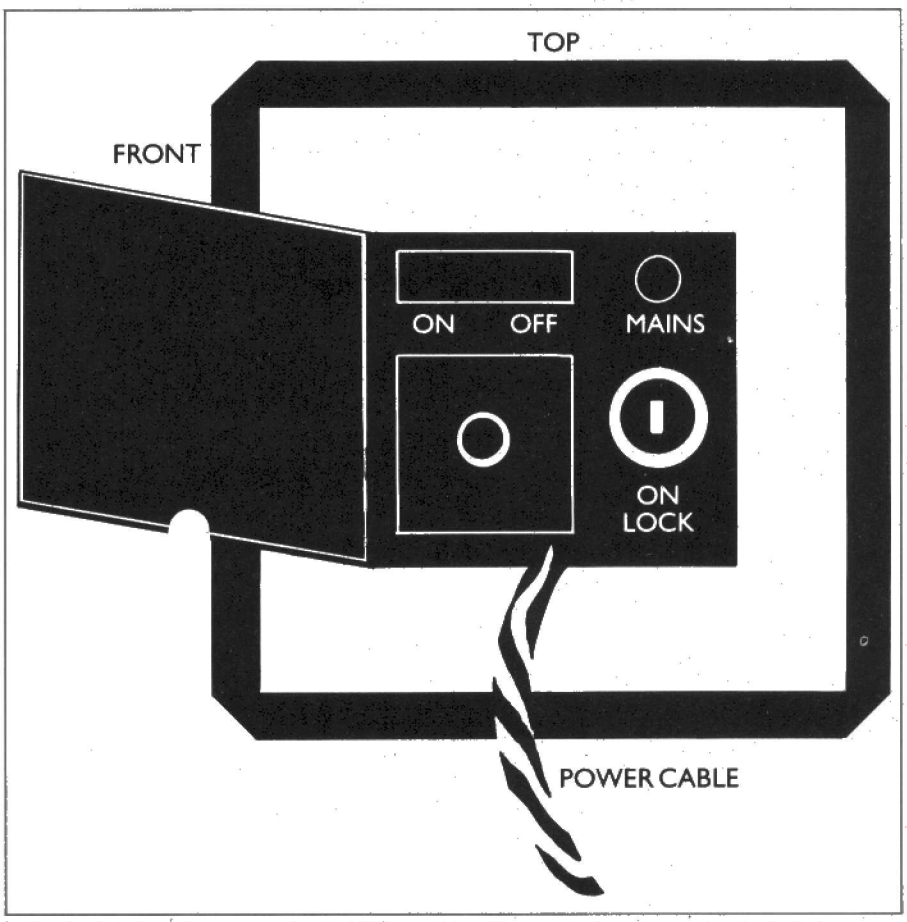


In the side hatch are the controls for the PSU complete with power-lock and securely-attached plug.

◀47 occurrence, then it will be impossible to create a data-conflict . . . something can't conflict with itself!

On the X-1, the user doesn't have to bother with details of device-handling. This is because the operations required are implied, if not explicitly stated, by the data concerning that state.

If a graph has been shown on the screen, and later a hard copy is wanted, then the user shouldn't have to do anything to the data itself, since the output is only a representation of that data. All he should have to do at most is to invoke the process again, but specify the plotter as the output device, rather than the screen.

Any set of data can be grouped, and whether it is interpreted as a collection of text-records in a file, as a picture or as a program, is left entirely up to the user. He specifies what is to be done with the data, not the machine, so if it seems useful to view a lot of five byte floating-point numbers as 0s and 1s, then there's nothing to stop it being requested.

All you need is a reason for doing something, and as soon as you have that, everything, no matter how stupid-looking, becomes perfectly sensible.

How the X-1 appears will depend partly on how much it's been used. This is because the user alters the default screen-format as he goes along . . . and here's another clue to the internal operation. When the machine is turned on, a data-set is loaded from disk. This is a collection of lists, containing the last set values for all kinds of operating-details, but if an emergency shut-down occurred, then an addition copy is loaded.

Naturally, this image is the same size as the memory, so it won't fit with the base data-set in there as well, not to mention the processing instructions, no matter how they are held. To overcome this, the memory image is analysed, and all irrelevant state-images are discarded. Such images would include any processes which had to have been completed before a fixed time, those which could no longer be performed because the relevant data-sets were no longer available or for which a specific piece of hardware was needed, but has been removed, and so on.

Whatever is left is then scanned to remove any data which is duplicated in the base set (*ie* the same data, with the same function). The remainder is now small enough to fit, and can be used as a subordinate data-set, supervised by the operations contained in the base data-set.

The process can now be continued, deactivated as the user orders, and as each one terminates, less and less remnants of the problem state remain.

Of course, all this assumes that the user has provided some kind of data to work on. But when it's first turned on (very first time, or after a complete erasure of the disks) there isn't any.

In order to get round this, a default data-set is provided which (if it's available) is loaded from the micro-floppy on bootup. This contains default-values for all operating parameters, data-sets which can be interpreted by the screen-handler as forms, the same for the printer and other devices, and data-sets which can be used as instructions, thus providing utility commands.

In use this data-set is modified by the user, mostly by interpolation and comparison, which allows the machine to modify the data-set so that the user makes less requests to change the format.

What happens is that whenever the user modifies a piece of data in certain data-sets, the machine makes a note of this. Next time a change is made to that same parameter a new entry is made in the list. Eventually the list will fill up, and when it does, the machine looks to see if there is any common feature. If so, it is fairly safe to assume that this is some kind of habit of the user. Thus, it would make sense to set that parameter to this value, or at least to ask if it might be a good idea.

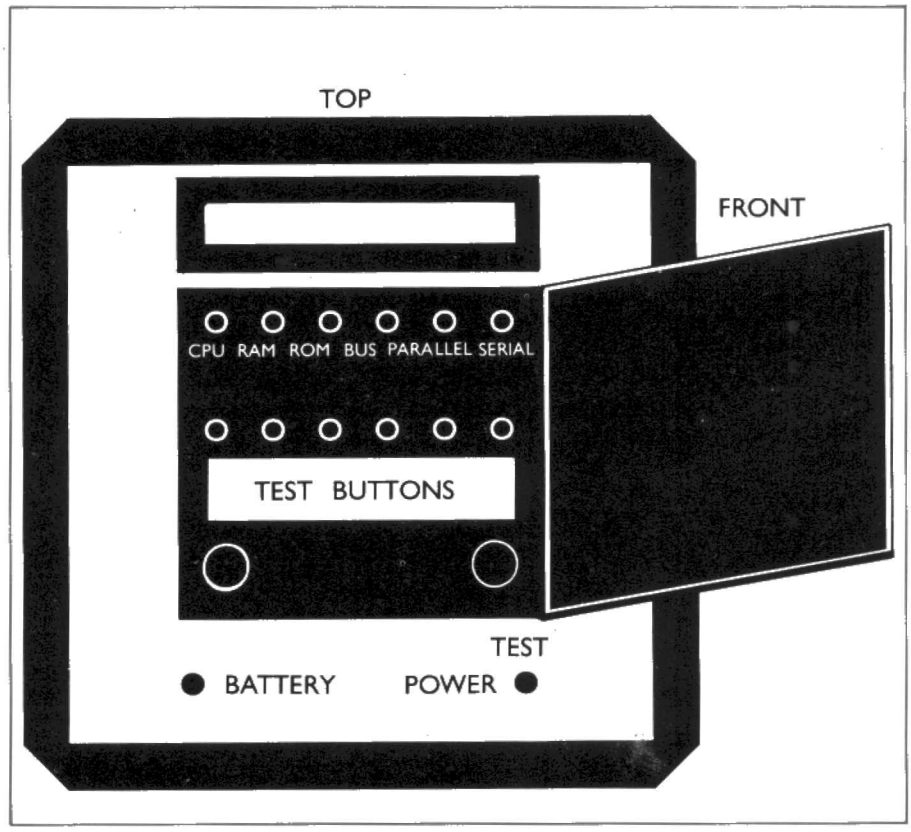
Of course, this also means that the user has to keep insisting before a new value becomes fixed, so a short-cut is available which allows any value to be reset immediately.

The most frequently used method lies somewhere in between these two. On many occasions it isn't convenient to force a change at base-level, and it isn't acceptable to take the default, so a process is permitted to make a temporary change to that parameter. The effect is that whenever that process is active, and has control of the service to which the parameter applies, then the 'local' copy is used.

This is actually accomplished by invoking a base-level process as though it were a subprocess of the active process. The reasoning is that if a process (albeit inactive) is present in memory, then it doesn't make sense to clone it. Far better to save its status, invoke it afresh, use it, and restore the previous status afterwards.

What are we going to do with it switched on all the time, then? Play around with the known data, for example, or look in sensible places for more. It could be useful to scan the various public-access databases, collecting any pages which have references to 'interesting subjects' (defined as a list by the user), or alternatively, look through the known data to see if there are any common features in files which have been defined as unrelated.

It isn't terribly important to make any fixed decisions about what should take place because, again, this is entirely up to the user . . . no need to say that printer-spooling is an activity which can be done in the background, or in slack moments . . . anything can be done at anytime, for any reason.



The other side hatch reveals various self-checking controls with three-colour LEDs to show the status of each major component.

Processor:	MC6800 (or possibly a 16032) running at 12.5 MHz
Display:	Base-processor 80 × 24, others available as modules
Storage:	3in micro-Winchester, 3.5in Sony micro-drive
ROM:	8K (2K self-check, 2K bootstrap, 4K monitor)
RAM:	128K minimum, expandable in 64K blocks to 1MK
Interfaces:	3 programmable Parallel, 3 programmable Serial
Expansion:	16 slots, each carrying a switched, isolatable copy of the main bus
Software:	None needed
Price:	£2,000 (minimum)—you don't expect all this for pennies, do you?

DUNGEON ADVENTURES

DRAGON 32

Tombs of treasure

Name Franklin's Tomb **System** Dragon 32 **Publisher** Salamander Software **Format** Cassette **Language** Basic **Outlets** Mail Order from Salamander Software and dealers.

What's a nice guy like me doing in a game list this? All the blurb in Franklin's Tomb, Salamander's latest jaunt for the Dragon, suggests it's about private dicks, seedy bars, damp cigarettes and invariably sticky lamposts.

But the game rapidly descends into yer-run-of-the-dungeon adventure. Franklin's tomb is the first of a series so bits of it will provide clues for future releases . . . all good clean fun.

Objectives

The objective is simply to 'solve the riddle'. Despite a 20-page (one reasonable bilge and thirteen of seedy illustrations) booklet, it's not clear what your aim is. Oh well, visit everywhere and collect anything that's not nailed down. It's a shame there is no scoring system.

In play

For an adventure written in Basic, Franklin's tomb does very well. Response times are not so slow as to be unbearable. You get a 'window' display with where you are, possible exits and your ill gotton gains always on display . . . it saves everybody a little hassle.

Apart from an opening theme that reminds me of a certain brightly coloured cat, the only attempt at sound and graphics is a beep when each command has been dealt with. Conversation is limited to the usual two-word commands such as REAL BOOK, OPEN DOOR and PLAY GAME.

There's the welcome and much needed ability to SAVE a game in mid play. But it could do with a few rough edges clearing up. There's no cursor. It won't take D for down.

Other than that, there are no surprises. Well . . . none that wouldn't spoil the game if I told you. Franklin's tomb isn't as difficult as some. The caves feel crammed rather than desolate. Books with messages in them, statues hiding keys and so on won't be beyond most players. You're also helped because the caves are essentially unpopulated.

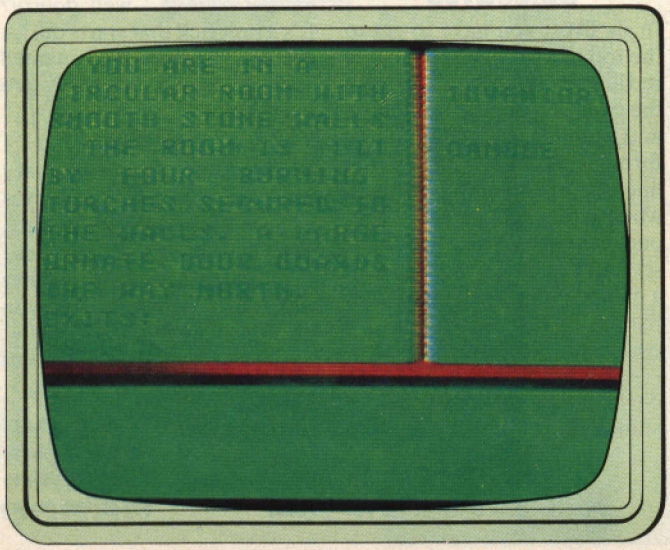
Verdict

Franklin's Tomb is a competent little game. It is going to appeal more to first timers than the hardened cave crawler . . . though the threat of a continuing series is very attractive. Still, 'when you've been in this business as long as I have, sugar, one dungeon looks pretty much the same as the next. . .'

Max Phillips

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	



SPECTRUM

Haunted rescue

Name Hummer House of Horror **System** 48K Spectrum **Price** £7 **Publisher** Lasersound, Stratford Workshops, Burford Rd, London E15 **Format** Cassette **Language** Basic and machine code **Other versions** None **Outlets** Mail order.

Hot off the presses we have Hummer House of Horror — a part, we are told, of a 'sensational collection of mind warping games' from Captain Lasersound. It's an adventure game set in a haunted house, and your objective is to race against the clock to rescue . . . well a maiden, of course.

Getting the thing loaded in the first place was something of an adventure. Enter LOAD"", say the instructions, and 'the process is entirely automatic from there on.' This will puzzle many an unfortunate novice, as the automatic process involves you stopping the tape half way through to collect your instructions.

Objectives

Once you've actually got it loaded, experienced the lengthy and rather nifty commercial for Lasersound — the best graphic in the game — and cooled your heels while the computer tells you 'Please wait', you can then start your quest.

You are in one of a series of rooms — round about 60 on four floors. In these rooms you'll encounter objects and creatures which are alleged to help you in your search.

In play

But hold on there, you may say — the cassette wrapping says 'superb 3D graphics'. What you actually see before you is a line-drawing representation of a room in 3D, a label at the top telling you who else is there — the Wild Woman, the Witch etc, and if you're lucky, a small graphic representing an object. You don't see the creatures, and the objects are so small they're easily missed.

You move around by the usual method, although picking up objects is tiresome, as you must, for example, specify 'Get Fido's din dins' — I kid you not — down to the last apostrophe.

The next problem is that 'for the unwary are traps'. This actually means for the unlucky are traps. There are various occasions when you blunder into something and get trapped/killed, but as these seem to be at random rather than at fixed locations, it's impossible to learn from your mistakes.

Verdict

The problem with this game is that it's very difficult to proceed in the way you normally do in an adventure. It isn't an ongoing learning process, as you're generally knocked out of it by random hazards rather than avoidable ones.

Theoretically I suppose it could be cracked, but it's more a question of probability than skill, and I gave up after several fruitless and not very entertaining hours.

John Lettice

RATING

Lasting appeal	
Playability	
Use of machine	
Value for money	

LEAPS & BOUNDS

COMMODORE 64

Jumps for Jupiter

Name Jumpman **System** Commodore 64 **Price** £27.50 **Publisher** Epyx **Format** Disk **Language** Machine Code **Other versions** None **Outlets** Maplin Electronic Supplies Ltd, PO Box 3, Rayleigh, Essex SS6 8LR. Tel: 0702 554155

This latest arcade game, supplied on disk for the Commodore 64, owes a little to Donkey Kong, the game that has you leaping over barrels and climbing girders to rescue the maiden in distress.

Objectives

Your joystick controls a little man, whose job is to climb to the top of all thirty one levels of play, and thus save Jupiter Headquarters from destruction.

On your way you have to climb up and down ropes, ladders, girders, take flying leaps into space, and avoid a hail of missiles, dragons, gunfighters and many other hazards, while still managing to pick up treasures.

First impressions

The initial screen gives you a 5 option 'menu' before play can commence.

You can start the game at a beginners, intermediate or an advanced level, progress through all the levels in sequence, or take a random option and just be swept along, never knowing which level you're going to encounter next.

Up to four players can join in the fun, and each individual level also has a choice of eight playing speeds, ranging from slow to suicidal.

The helpful manual suplied, as well as telling you how to play the game, contains a number of valuable hints for achieving vast scores.

In play

Making wonderful use of graphics and sound, the game requires much more than just quick reactions. As you start being chased by robots, or collecting treasures that render you invisible, you also have to be able to think, and solve the problems presented to you logically as well as quickly.

Perhaps two girders don't quite join up, the ladder snaps in two after you've climbed it, treasures hang in mid-air seemingly beyond reach, or any one of a hundred other problems face you as you go through the levels.

All of them can be solved, but it will take some time, and your seven lives seems a meagre allowance.

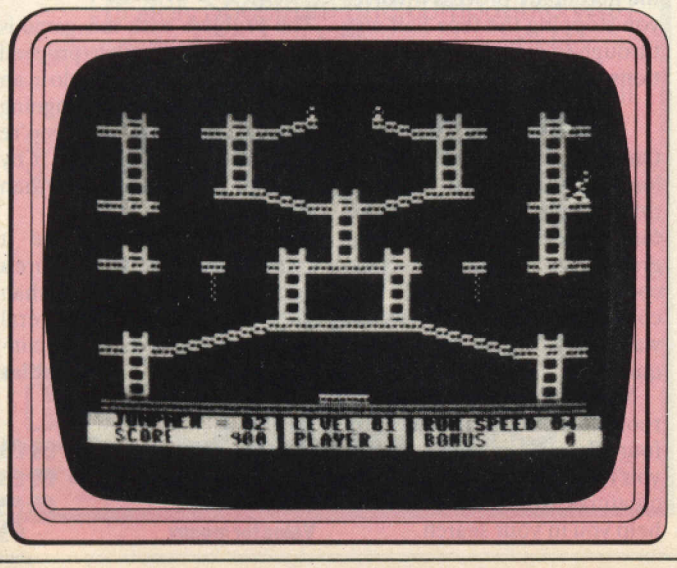
Verdict

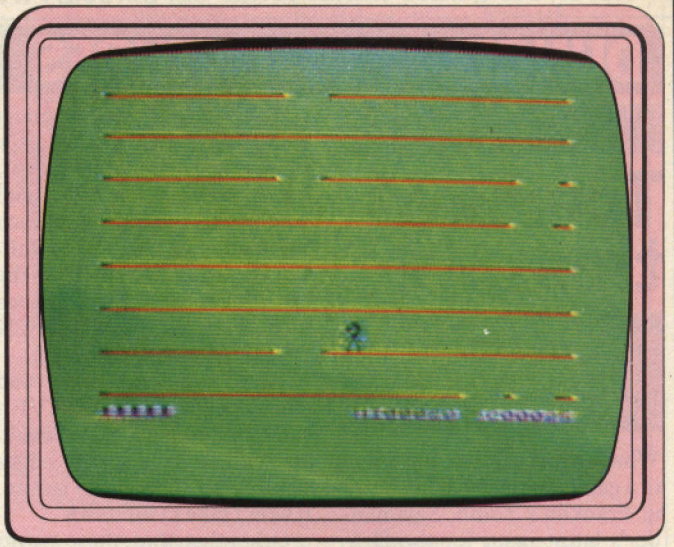
The best arcade game I've seen for the Commodore 64, and one that will have you playing well into the early hours of the morning. Fast and frustrating it is simply brilliant!

Pete Gerrard

RATING

Lasting appeal	
Use of machine	
Playability	
Value for money	





SPECTRUM

Sizzling power line

Name Jumping Jack **System** 16K Spectrum **Price** £5.50 **Publisher** Imagine software 051 236 0407 **Format** Cassette **Language** Machine code **Outlets** Sinclair dealers

Remember learning kerb drill or even the Green Cross Code? When you stood at the edge of the pavement looking right . . . and left . . . and right again and if all was clear, then cross keeping a constant watch.

With Jumping Jack, you can relive those dear dead days, only instead of charging across the street, you have to leap up a set of red lines which not only won't stand still, but are also infested with ghosts and dinosaurs and all those everyday hazards.

Objectives

In six lives, you have to get to the top of a set of eight moving red lines by jumping up through the gaps that appear randomly, and running to avoid falling through gaps that appear in the line you are standing on. And when you've got to the top of one set of lines, you get another set, but this time complete with a menace which will knock you flying. The more screens you complete, the more menaces — but each time you fall back down to basecamp, you lose another life.

In play

Imagine has come up with yet another game that has good graphics, an original plot, and the sort of game you just can't stop playing.

Jack, the hero, is a Hungry Horace-like pair of eyes on legs, looking left and right as you wait for a suitable gap to appear in the line above you. And as soon as the line he's standing on is threatened with an approaching gap, and you get him running left or right, his dinky little legs go nineteen to the half dozen.

If you try to jump through a suitable looking gap too soon or late, Jack apparently gets electrocuted — are these red lines power lines? — and lies on his back waving his legs in the air. While he's incapacitated, and looking uncannily like a helicopter, holes creep up beneath him, so it's quite easy to end up at square one.

The lines can also hunt in two directions, so as fast as Jack tries to run one way, he's still in danger of being confronted with another hole headed straignt for him. A dirty trick.

Complete a screenful, and you get a line of — well, poetry? It's a limerick that starts out 'A daring explorer named Jack . . .' and presumably gets even worse.

Verdict

Stirring stuff, simple but very addictive. You get enough lives to make a fair impression on the game even on startup. As there are only three keys to bother with, left, right and up, you won't get your digits in a twist.

Shirley Fawcett

RATINGS

Lasting appeal	
Playability	
Use of machine	
Value	

SHOOT 'EM DOWN

VIC 20

Alien Waves

Name Fourth Encounter **System** Vic 20 **Price** £25 **Publisher** Thorn-EMI **Format** Cartridge **Language** Machine code **Outlets** High street dealers

Fourth Encounter, confides the blurb, is a space game with a difference. You can be forgiven if optimism once again triumphs over experience. I too thought this might be the one some of us have long hoped for, the game where you really do befriend the aliens instead of vapourising them. The one where, by flashing a few lights and playing the right jingle, you are accepted into the galactic equivalent of Thomas Cook's Travel Club.

Alas . . .

Presentation

There are books designed not to be read but only to grace teak bookshelves. Thorn-EMI seems to have copied the concept in its computer games: the packaging here is nothing short of gorgeous.

The cartridge, in hunky black plastic, comes in a matching case with a booklet of instructions featuring a full colour illustration. Lavish?

Unfortunately, the blurb gives the game away. 'Wave after wave . . . blast your ferocious foe . . . lethal laser bolts.'

In play

Dedication is called for here. Press 'F1' to get the menu then set skill level, choose play or practice mode, one or two player game then you're off. Don't die too quickly because you have to go through that rigmarole every time around.

Once into the game things improve. The graphics and sound are excellent.

After that, what is there to say? Everyone knows the scenario (wave after wave etc). In keeping with the Gucci packaging these are jolly cute aliens — the first bunch look like chinese lanterns, the second like Disney cartoon jellyfish.

The big build-up, of course, is for round four (Fourth Encounter!) but Thorn-EMI spoils it all by letting you go straight to it in practice mode.

But it's all so dull. Everything happens at a suitably fast and furious pace, lasers zap in deadly fashion, foes attack ferociously, wave precedes wave according to script.

It's impossible to fault Fourth Encounter (though Thorn could zap its master of cliche in the blurb-writing department) and equally impossible to praise..

Verdict

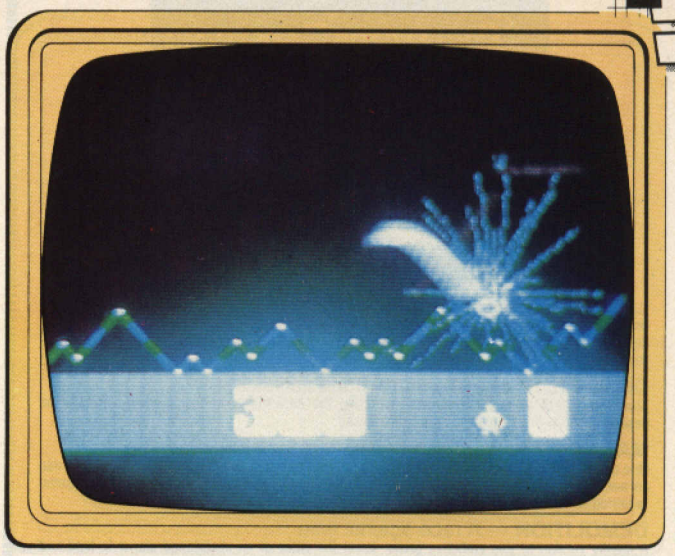
If you have teak bookshelves standing empty against your designer-matched fabric wallpaper, buy it. If not you can buy better programs for one third of the price.

Best of all, buy a real Space Invaders. You can't beat an original masterpiece.

Peter Worlock

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	



COMMODORE 64

Whirling Wonder

Name Cyclons **System** Commodore 64, joystick **Price** £5.99 **Publisher** Rabbit Software 01-863 0833 **Format** Cassette **Language** Machine Code **Other Versions** Vic 20 **Outlets** Mail order, dealers.

This is one of the few arcade games where it is a pleasure to be defeated by the aliens! Cyclons has some rather good variations on the usual shoot-em-down arcade game.

Your space ship is a revolving sphere-like craft, the faster it whirls, the faster it moves and fires. Motion is smooth and accurate. It takes a little practice to get the hang of controlling the ship. If it meets the edge of the screen, it bounces back. Although it can fire in any direction, it will only do so in the direction it is currently moving.

Objectives

There are only two types of enemy. The first are small red lightning flashes which spin head over heel around the screen, carelessly tossing out missiles as they go. They tend to blow each other up if you can keep out of their way.

The second is a spinning flying saucer which unerringly heads after you. Your sole objective is to score as many points as possible before losing all five lives.

When either you or the enemy are hit, the result is rather beautiful. A shower of coloured lights explodes across the screen, accompanied by a gentle 'woooosh', the total effect being reminiscent of a sky rocket at the moment of its starburst. Beware, the debris can destroy your own ship.

In play

The title page is created to the strains of an extremely impressive version of the Star Wars theme, showing off the 64's powerful music capabilities. This is followed by a screen menu of the game's options. You can play on any of four difficulty levels: beginner, regular, advanced or expert.

Mountainous terrain can be introduced, missiles can ricochet off the screen edges, and the top four scores (with scorers' initials) can be displayed.

The ranking system lets you enter three initials, in large size letters, against your score. The options can be used in a variety of combinations and are each selected by pressing one of the function keys.

One thing that neither the cassette sleeve or the program tells you is that you can return to the menu after each game by pressing the upward arrow key.

Verdict

The whole program, from title sequence and option menu to game and ranking system, has all the marks of professionalism. I found it a delight, as well as great fun, to play. With more programs like this, Rabbit Software might well corner the market in Commodore 64 games software.

Bob Chappell

RATING

Lasting appeal	
Playability	
Use of machine	
Overall value	

PCN ProgramCards

Stand by your keyboards all owners of Vics, Spectrums, BBCs and Commodore 64s. There are ProgramCards for all of you this week.

To start with, a game for the Spectrum from Richard Jones, of Stafford. Money Maze is a spot of harmless larceny with the player attempting to find the money in the maze and make a run for it, all the while avoiding the attentions of the guard.

Still on the games front, we have a simple but addictive game for the Commodore 64. Bomber, from Jamie Clyde, of Edinburgh, is a version of one of the standard computer games which involves you in blasting a city to smithereens in order to get your plane down safely.

ProgramCards also features two utility programes this week. The first of these is from Jason Hobbs, of East Tilbury, Essex, and is for the Vic 20.

It is a simple filing system that will allow you to catalogue a small collection.

Even if the application doesn't interest you, it might be worth entering and running the program because Jason has used some excellent effects in the introductory sequence which could be transported to your own programs.

Finally, from A Phillips, of Southport, Merseyside, there is a character definition utility for the BBC Micro.

As it is presented here, Definer runs on the Model B but with the following modifications it will run on the Model A.

Change line 70 to Mode 4; change line 350 to YEL$ = CHR$ 17 + CHR$ 1; and finally, delete line 650. The program allows you to define characters 224 to 255 and save them to tape. To get them back simply use *LOAD "CHARS".

PCN Programs Editor

PCN wants you. That is, if you can understand *and* explain other people's programs, spot a bug in the heart of a listing, have done time on a number of micros running different dialects of Basic and have more than a passing familiarity with Pascal, Fourth and other popular languages.

If this sounds like you, write with CV to: Cyndy Miles, Editor, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

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The Programs Editor, *Personal Computer News*, VNU, 62 Oxford street, London W1A 2HG.

All disks and cassettes will be returned as soon as possible after evaluation or publication, at our expense.

PCN ProgramCards

Money Maze — Card 1 of 3

8321MM1/3

A simple game with nine levels of difficulty

```
  1 LET OW=0: GO SUB 8000: FOR j=1 TO 100: NEXT j
  2 GO SUB 2000
  3 LET s=400
  4 PRINT "YOU ARE REPRESENTED BY:"; FLASH 1;"*"' FLASH 0;"THE GUARD IS THE ";
FLASH 1;"£"
  5 FOR F=1 TO 500: NEXT F: CLS
  7 LET p=0
 10 DIM q(22,32)
 20 FOR f=1 TO (z*20)+50
 30 LET a=INT (RND*18)+3
 40 LET b=INT (RND*28)+3
 50 PRINT AT a,b;" "
 60 LET q(a,b)=1
 70 NEXT f
 75 GO SUB 1000

 80 LET c=INT (RND*17)+2
 90 LET d=INT (RND*27)+2
100 LET q(c,d)=0
110 PRINT  FLASH 1;AT c,d;"*"
115 LET q(c,d)=0
120 LET a=INT (RND*17)+2
130 LET b=INT (RND*27)+2
135 LET q(a,b)=0
140 IF a=c OR b=d THEN  GO TO 120
150 PRINT AT a,b; FLASH 1;"£"
152 PRINT  PAPER 4;AT 3,3;" ";AT 3,30;" ";AT 20,3;" ";AT 20,30;" "
153 LET q(3,3)=0: LET q(3,30)=0: LET q(20,3)=0: LET q(20,30)=0
154 PAUSE 200
155 LET a1=a: LET b1=b: LET c1=c: LET d1=d
156 LET s=s-1
```

Sinclair Spectrum Spectrum Basic

Application: Game
Author: Richard Jones

1	Call sub-routine for instructions
2	Call sub-routine for skill level selection
10-70	Set array to hold maze and draw it on screen. NB: space between quotes in line 50 should be inverse graphic 8
75	Call sub-routine to print money in maze
80-150	Set up start positions
152	Print home squares
155	Start of main loop
156	Decrement time counter

PCNProgramCards

Money Maze — Card 2 of 3

8321MM2/3

```
 157 PRINT AT 0,0;s;"  "
 158 IF s=0 THEN  GO TO 4000
 160 LET c=c+(INKEY$="6" AND q(c+1,d)<>1 AND c<20)-(INKEY$="7" AND q(c-1,d)<>1 A
ND c>3)
 170 LET d=d+(INKEY$="8" AND q(c,d+1)<>1 AND d<30)-(INKEY$="5" AND q(c,d-1)<>1 A
ND d>3)
 180 LET a=a+(c>a AND q(a+1,b)<>1)-(c<a AND q(a-1,b)<>1)
 190 LET b=b+(d>b AND q(a,b+1)<>1)-(d<b AND q(a,b-1)<>1)
 200 PRINT AT a1,b1;" ";AT c1,d1;" "; FLASH 1;AT a,b;"£";AT c,d;"*"
 210 IF a=c AND d=b THEN  GO TO 500
 220 IF q(c,d)=2 THEN  LET p=p+INT (RND*10)*10+10: LET q(c,d)=0
 230 IF (c=3 AND d=3) OR (c=20 AND d=3) OR (c=3 AND d=30) OR (c=20 AND d=30) THE
N  GO TO 1500
 235 IF (INKEY$="t" OR INKEY$="T") AND 0W=0 THEN  LET 0W=1: GO SUB 3000
 240 GO TO 155
 500 PRINT AT 0,0;"YOU WERE CAUGHT WITH ";p;AT 1,0;"ON YOUR HANDS....";AT 2,0;"
SEE YOU IN PRISON!";AT 3,0;"PRESS ""Y"" FOR ANOTHER GO"
 510 IF INKEY$<>"y" THEN  GO TO 510
 520 RUN
 999 STOP
1000 FOR f=1 TO 25
1010 LET a=INT (RND*18)+3
1015 LET b=INT (RND*28)+3
1020 PRINT AT a,b;"£"
1030 LET q(a,b)=2
1040 NEXT f
1050 RETURN
1500 PRINT AT 0,0;"YOU HAVE ESCAPED WITH ";p;AT 1,0;"WITH ";s;" TIME UNITS TO S
PARE";AT 2,0;"PRESS ""Y"" FOR ANOTHER GAME"
1510 IF INKEY$<>"y" THEN  GO TO 1510
1520 RUN
```

160-170	Move robber
180-190	Move guard
200	Print guard and robber
210	Check for capture
220	Check for money
230	Check for escape
235	Check for enclosure
240	End of main loop
500-520	Defeat and option for another go
1000-1050	Print money
1500-1520	Success

PCNProgramCards

Money Maze — Card 3 of 3

8321MM3/3

```
2000 PRINT "ENTER SKILL LEVEL...              (1=HARD TO 9=EASY)"
2010 IF INKEY$="" THEN  GO TO 2010
2020 LET z=CODE INKEY$-48
2023 IF z<1 OR z>9 THEN  GO TO 2010
2030 CLS
2040 RETURN
3000 PRINT AT c+1,d;" ";AT c-1,d;" ";AT c,d+1;" ";AT c,d-1;" "
3010 LET q(c+1,d)=0
3020 LET q(c-1,d)=0
3030 LET q(c,d+1)=0
3040 LET q(c,d-1)=0
3050 LET s=s-20
3060 RETURN
4000 PRINT AT 0,0;"YOU HAVE RUN OUT OF TIME...";AT 1,0;"YOU "; INVERSE 1;"DID";
INVERSE 0;" HAVE ";p;AT 2,0;"PRESS ""Y"" FOR ANOTHER GAME"
4010 GO TO 1510
8000 BORDER 6: PAPER 6: INK 0: CLS
8020 CLS : PAPER 1: INK 7
8040 PRINT AT 1,13;"MONEY";AT 1,13; OVER 1;"_____"
8050 PRINT AT 3,0;"IN THIS GAME YOU HAVE TO ESCAPE "'"FROM THE SCREEN TO ONE OF
 THE   "'"COLOURED SQUARES IN THE CORNERS "'"WITH AS MUCH MONEY AS POSSIBLE, "
'"BEFORE THE TIMER RUNS OUT. TO   "'"MAKE MATTERS WORSE THERE IS A   "'"GUARD
 WHO CHASES YOU. IF YOU ARE"'"COMPLETELY ENCLOSED YOU MAY     "'"ESCAPE BY PRE
SSING ~T~
"
8060 PRINT AT 21,0; INK 6; PAPER 2;"  PRESS ANY KEY TO CONTINUE...  "
8070 PAUSE 0
8080 PAPER 6: INK 0: CLS : RETURN
```

2000-2040	Input and checking routine for skill level
3000-3060	Sub-routine to delete surrounding squares in enclosure
4000-4010	Run out of time. Option for another game
8000-8060	Sub-routine for instructions

PCN ProgramCards

Collection — Card 1 of 3

8321C1/3

A small, but useful, program to catalogue a collection of items incorporating interesting screen use.
Written for the author's record collection, it could easily be adapted.
NB: See ProgramCard 8307CC for list of CBM control codes.

Vic 20
Commodore Basic

Application: Data catalogue
Author: Jason Hobbs

```
10 S1=36874:S2=36864
20 POKES1+5,9:PRINT"■"
30 FORT=200TO40STEP-1:POKES2+1,T
35 FORI=1TO11:NEXTI,T
40 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■"
50 PRINT"■■■                    *"
60 PRINT"■■■    COLLECTION      *"
70 PRINT"■■■                    *"
80 PRINT"■■■                    *"
90 PRINT"■■■                    *"
100 PRINT"■■■                    *"
110 PRINT"■■■                    *"
120 PRINT"■■■                    *"
130 PRINT"■■■                    *"
140 PRINT"■■■■■■■■■■■■■■■■■■■■"
150 POKES1+3,220
160 FORL=15TO0STEP-1
170 POKES1+4,L
180 FORM=1TO300
190 NEXTM,L
200 POKES1+3,0
210 POKES1+4,15
221 FORI=0TO22
222 POKES1,230+I
223 POKES2,12+I
224 POKES2+1,38+I
225 POKES2+2,150-I
226 POKES2+3,174-I*2
227 NEXTI
```

10-35	Set screen and border colours, fine-scroll the display up on to the screen using Video Interface Chip registers
150-210	Explosive end to scrolling
221-227	Contracts screen to sound accompaniment

PCN ProgramCards

Collection — Card 2 of 3

8321C2/3

```
228 POKES1,0
229 POKES1+5,24
230 RESTORE:PRINT"■■■■■■■■■COLLECTION"
240 PRINT"■■■■■■■■■■■■■■■■■■■■"
250 PRINT"■OPTIONS"
260 PRINT"■■■■■■■■■■■■■■■■■■■■"
270 PRINT"■WHICH WAY WILL YOUENTER THE INFORMATION"
280 PRINT"■■BY THE ■■Y■EAR"
290 PRINT"■BY THE ■■T■ITLE"
300 PRINT"■OR ■■E■ND"
301 FORI=22TO0STEP-1
302 POKES1,230+I
303 POKES2,12+I
304 POKES2+1,38+I
305 POKES2+2,150-I
306 POKES2+3,174-I*2
307 NEXTI
308 POKES1,0
310 GETZ$:IFZ$=""THEN310
320 IFZ$="T"THEN440
330 IFZ$="E"THEN530
340 PRINT"■■ENTER YEAR          (BETWEEN 1963-1970)"
350 INPUTY$
360 PRINT"■THE RECORDS IN MY COLLECTION MADE IN"Y$" ARE:"
370 FORI=1TO23
380 READA$,B$
390 IFY$=B$THENPRINT"■■"A$
400 NEXTI
410 PRINT"■■■■PRESS ANY KEY TO■  ■RETURN TO OPTIONS■"
420 GETR$:IFR$=""THEN420
430 PRINT"■":GOTO221
```

228-300	Turns off volume, changes screen and border colours and lists options
301-307	Expands screen to full size with sound effects
308-330	Turns off sound and accepts input option
340-350	Input year
360-400	Reads date. If year found then print items
410-430	Maintain display until key pressed, then return to menu

PCN ProgramCards

Collection — Card 3 of 3

8321C3/3

```
440 PRINT"■■ENTER TITLE"
445 INPUTT$
450 FORI=1TO23
460 READA$,B$
470 IFA$="ZZZ"THENPRINT"■SORRY "T$:PRINT"■IS NOT IN YOUR■■■■■■■■COLLECTION■":GOS
UB535
480 IFT$=A$THENPRINT"■■"A$:PRINT"IS IN YOUR COLLECTION":PRINT"IT WAS MADE IN "B$
:GOTO500
490 NEXTI
500 PRINT"■■■PRESS ANY KEY TO■      ■RETURN TO OPTIONS■"
510 GETR$:IFR$=""THEN510
520 PRINT"■":GOTO221
530 POKES1+5,27:PRINT"■BYE-BYE HAPPY RECORD  PLAYING!!■":END:POKES1+4,0
535 FORI=1TO200:POKES1,199:NEXTI:POKES1,0:RETURN

540 DATAPLEASE PLEASE ME,1963
550 DATAFROM ME TO YOU,1963,SHE LOVES YOU,1963
560 DATAI WANT TO HOLD YOUR HAND,1963
570 DATACAN'T BUY ME LOVE,1964
580 DATAA HARD DAY'S NIGHT,1964,I FEEL FINE,1964
590 DATATICKET TO RIDE,1965,HELP,1965
600 DATADAY TRIPPER,1965
610 DATAPAPERBACK WRITER,1966
620 DATAYELLOW SUBMARINE,1966
630 DATAPENNY LANE,1967,ALL YOU NEED IS LOVE,1967
640 DATAHELLO GOODBYE,1967,LADY MADONNA,1968
650 DATAHEY JUDE,1968,GET BACK,1969
660 DATATHE BALLAD OF JOHN AND YOKO,1969
670 DATASOMETHING,1969,LET IT BE,1970
680 DATASGT.PEPPERS LONELY HEARTS CLUB BAND,1967
690 DATAZZZ,ZZZ
```

440-445	Input title of item
450-490	Reads data. Returns ZZZ if item not found. If search successful prints message
500-520	Maintains display and waits for key press before returning to menu
530-535	End routine. Change screen and border colour, print message
540-690	Data. Substitute your own information in this section

PCN ProgramCards

Bomber — Card 1 of 3

8321B1/3

A simple but addictive game with six skill levels. Set Program Card 8307CC for control codes.

```
100 GOSUB1000
200 GOSUB2000:GOSUB710:POKE54296,15
210 FORJ=1TO30
220 FORT=20TORND(1)*10+(9-LEV)+5STEP-1
230 POKE1024+J+40*T,160:POKE55296+J+40*T,5
240 NEXTT,J
249 REM * MAIN LOOP *
250 FORB=7TO19:H=LEV+1:FORA=0TO39:O=A+40*B
260 GETA$
270 IFA$=" "THENGOSUB500
275 IFPEEK(1025+O)=160THEN4000
280 POKE1023+O,32:POKE55295+O,6
290 POKE1024+O,252:POKE55296+O,6
300 POKE1025+O,98:POKE55297+O,6
320 NEXTA:GOSUB400:NEXTB
330 GOSUB800:GOTO210
399 REM * DELETE PLANE *
400 POKE1023+O,32:POKE55296,2
440 RETURN
499 REM *FIRING ROUTINE *
500 H=H-1:IFH<1THENRETURN
505 FORQ=B+2TO19:W=A+40*Q
510 IFPEEK(1024+W)=160THENGOSUB600
520 POKE1024+W-40,32:POKE55256+W,2
530 POKE1024+W,30:POKE55296+W,2
540 NEXTQ
550 RETURN
```

Commodore 64
Commodore Basic

Application: Game
Author: Jamie Clyde

100	Call up initialisation sub-routine
200	Call titles and instructions sub-routine
210-240	Build skyline
250-330	Loop to move plane across sky, detect bombs away, report crash and update score
400-440	Remove plane at end of each pass
500-550	Drop a bomb if any left on current pass

PCNProgramCards

Bomber Card 2 of 3

8321B2/3

```
599 REM * DESTROY BUILDING *
600 S=S+10
610 PRINT"■■SCORE■";S
620 POKE54276,129
630 POKE54272,HF(Q-7):POKE54273,HL(Q-7)
640 FORT=1TO10:NEXT:POKE54276,0
650 RETURN
699 REM * GAME SCORE *
710 PRINT"■■SCORE■";S;TAB(20)"■HIGH SCORE■";H(1)
720 PRINT"■■■";TAB(10)"LASTSCORE■";L
730 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■";TAB(6 );"■CHAMPION: ■";H$(1)
735 PRINTTAB(8)"■BOMBS PER SWOOP:■";LEV
740 RETURN
799 REM * PREPARE NEW SCREEN *
800 POKE54276,17
805 FORU=3TO7STEP2:POKE54272,LF(U):POKE54273,HF(U):GOSUB870 :NEXT
810 FORU=7TO3STEP-2:POKE54272,LF(U):POKE54273,HF(U):GOSUB870:NEXT
820 PRINT"□":GOSUB710
830 POKE54276,0
860 RETURN
870 FORUP=1TO200:NEXT
880 RETURN
999 REM * SET UP VARIABLES *
1000 DIMH(10),H$(10),HF(20),HL(20)
1010 FORT=54272TO54285:READK:POKET,K:NEXT
1020 FORT=1TO20:READHF(T),HL(T):NEXT
1030 FORK=1TO10:H$(K)="THE COMPUTER"
1040 NEXT
1090 RETURN
1999 REM * RESTART GAME *
2000 L=S:S=0
2080 POKE53280,7:POKE53281,7:PRINT"□"
2085 GOSUB6000:PRINT"□"
2090 RETURN
3999 REM * END OF GAME ROUTINE *
4000 POKE1024+O,102:POKE55296+O,2:POKE54276,129
4010 POKE43272,75:POKE54273,34:FORYU=1TO500:NEXT:POKE54276,0
4040 PRINT"□":POKE53280,4:POKE53281,7
4050 FORI=1TO10:IFS>H(I)THENGOSUB4500:GOTO4070
4060 NEXT
```

600-650	Remove building where bomb hits
710-740	Print score lines for game
800-860	Routine to prepare new screen for pass
870-880	Pause routine
1000-1090	Routine to set up user-defined graphics
2000-2090	Sub-routine to set up new game and call instructions
4000-4060	End of game routine and check for top ten scorers

PCNProgramCards

Bomber Card 3 of 3

8321B3/3

```
4070 PRINT"□";TAB(10)"■■BOMBING TOP TEN "
4080 PRINT"■■"
4090 FORO=1TO10:PRINTTAB(5)O;TAB(10)H(O);TAB(20)H$(O):NEXT
4100 PRINT"■■■   PRESS FUNCTION KEY 1 TO RESTART      "
4110 GETR$:IFR$<>"■"THEN4110
4120 GOTO200
4499 REM * ENTER NEW NAME *
4500 FORC=9TOISTEP-1:H(C+1)=H(C):H$(C+1)=H$(C):NEXT
4510 PRINTTAB(10)"■■■■■ELL DONE"
4520 PRINT"■■■■YOUR SCORE IS IN THE TOP TEN SCORES"
4530 PRINT"■■■■■■■■■■PLEASE ENTER YOUR NAME"
4540 INPUTH$(I):H$(1)=LEFT$(H$(I),19)
4560 H(I)=S:I=10
4570 RETURN
5999 REM * TITLE PAGE *
6000 REM
6010 PRINT"■":F$="* BU■BER *":LEV=1
6020 FORUI=1TO37:PRINTTAB(UI)"□ ■■"
6030 IFUI>14THENPRINTTAB(15)"□";LEFT$(F$,UI-14)
6035 FORGH=1TO10
6040 NEXTGH,UI:PRINT"□□";TAB(38)"  "
6045 PRINTTAB(7)
6050 PRINT"■■";TAB(12)"■BOMBS PER SWOOP ";LEV
6060 PRINT"■■■■■■■■■■ DESTROY A GROUP OF BUILDINGS"
6070 PRINT"■■■■■■■■■■■HAVE FEW BOMBS PER SWOOP"
6080 PRINT"■■■■■■TO RELEASE BOMB PRESS SPACE-BAR"
6090 PRINT"■■■■■PRESS 'F1' TO  CHANGE NO.OF BOMBS"
6095 PRINT"■■■■■■AME ENDS WHEN YOU HIT BUILDING"
6100 PRINT"■■■■■■■■■■ H A P P Y  L A N D I N G S"
6110 PRINT"■■■■■■■■■■■  PRESS SPACE BAR TO BEGIN  "
6120 GETD$
6130 IFD$=" "THENRETURN
6140 IFD$<>"■"THEN6120
6150 LEV=LEV+1:IFLEV=7THENLEV=1
6160 PRINT"■■■■■";TAB(12)"■BOMBS PER SWOOP ";LEV:GOTO6120
10000 DATA0,0,0,0,129,255,255,0,0,255,15,65,255,255
10010 DATA7,53,8,23,8,147,9,159,10,205,11,114,12,216,14,107,16,47,17,37,19,63
10020 DATA21,154,22,227,25,177,28,214,32,94,34,75,38,126,43,52,45,198
```

4070-4120	Routine to display top ten scores and names with prompt for next game
4500-4570	Routine to enter name into top ten list
6000-6160	Routine to display instructions and allow change in difficulty level (number of bombs per pass)
10000-10020	Data statements for user-defined graphics loaded by routine at 1010-1020

PCN ProgramCards

Definer Card 1 of 4

8321D1/4

A practical utility for BBC programmers that allows the creation and storage of user-defined characters.

```
 30 ONERROR GOTO160
 40 PROCinit
 50 PROCarrays
 60 REPEAT
 70   MODE1
 80   PROCgrid
 90   REPEAT
100     PROCinput
110     UNTIL Inp$=" "
120   MODE5:PROCnew
130   UNTIL G%=83
140 MODE7:*SAVE "CHARS" C00 D00
150 GOTO180
160 IF ERR=17 RUN
170 MODE7:REPORT:PRINTERL
180 *FX4,0
190 END
200 :::::::::::::::::::::::::::::::::
210 DEFPROCinit
220 *FX4,1
230 C%=224
240 DIM X1%(64),X2%(64),Y1%(64),Y2%(64)
250 DIM Val%(8),Tot%(8),VY%(8)
260 G$="ABCDEFGH"
270 SCord$="A1A2A3A4A5A6A7A8B1B2B3B4B5"
280 SCord$=SCord$+"B6B7B8C1C2C3C4C5C6"
290 SCord$=SCord$+"C7C8D1D2D3D4D5D6D7"
300 SCord$=SCord$+"D8E1E2E3E4E5E6E7E8"
310 SCord$=SCord$+"F1F2F3F4F5F6F7F8G1"
320 SCord$=SCord$+"G2G3G4G5G6G7G8H1H2"
330 SCord$=SCord$+"H3H4H5H6H7H8"
340 RED$=CHR$17+CHR$1
350 YEL$=CHR$17+CHR$2
360 WHI$=CHR$17+CHR$3
370 ENDPROC
380 :::::::::::::::::::::::::::::::::
```

BBC Model B
BBC Basic

Application: Utility
Author: A Phillips

30-190 The main program loop which has full control over the remainder of the program, calling relevant procedures as required. It repeats until enter 'S' for SAVE. It then stores the file, resets the editing keys and ends

210-370 Set up all arrays and define the control strings for colour and screen displays

PCN ProgramCards

Definer Card 2 of 4

8321D2/4

```
390 DEFPROCarrays
400 FORI%=1TO8:READY%:VY%(I%)=Y%:NEXTI%
410 DATA5,8,11,14,18,21,24,27
420 X%=104:Y%=804
430 FORI%=1TO64
440   X1%(I%)=X%
450   X2%(I%)=X1%(I%)+92
460   Y1%(I%)=Y%
470   Y2%(I%)=Y1%(I%)+92
480   IF I% MOD 8=0 THEN X%=X%+100:Y%=804 ELSE Y%=Y%-100
490   NEXTI%
500 ENDPROC
510 :::::::::::::::::::::::::::::::::
520 DEFPROCgrid
530 VDU5
540 GCOL0,3
550 GX%=100:GY%=100:GXX%=100:GYY%=100
560 FORI%=1TO9
570   MOVEGX%,GY%:DRAW900,GY%
580   GY%=GY%+100
590   MOVEGXX%,GYY%:DRAWGXX%,900
600   GXX%=GXX%+100
610   NEXT I%
620 GCOL0,1
630 MOVE1148,540:DRAW1248,540:DRAW1248,440:DRAW1148,440:DRAW1148,540
640 GX%=140:GY%=856
650 GCOL0,2
660 FORI%=1TO8
670   MOVE48,GY%:PRINT;I%
680   MOVEGX%,944:PRINT MID$(G$,I%,1)
690   GX%=GX%+100:GY%=GY%-100
700   NEXTI%
710 VDU4
720 FORI%=1TO8
730   PRINTTAB(31,VY%(I%))"0"
740   NEXTI%
750 PRINTTAB(1,1)RED$;"(Press SPACE BAR for next character)"
760 PRINTTAB(30,3)RED$;"Value"
770 PRINTTAB(36,13)YEL$;"CHR";TAB(36,14)STR$(C%)
780 ENDPROC
790 :::::::::::::::::::::::::::::::::
```

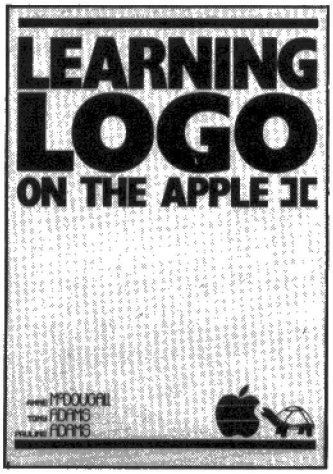
390-500 Procedure to fill the arrays defined in PROCinit

520-740 Draws the editing grid and displays screen co-ordinates

750-780 Space bar allows scrolling through the character set

Continued next week

PCN reviews the latest contenders for space on your bookshelf.



'Learning Logo on the Apple II' by Anne McDougall, Tony Adams and Pauline Adams, published by Prentice-Hall at £11 (paperback, 250 pages)

Seldom have I heard of, let alone read, an instruction manual/tutorial that is excellent. This one is by far and away the most instructive book I have come across.

Even a non-novice can appreciate the amount of effort that has gone into producing a really down-to-earth step-by-step book. Not only does it start from the premise that the reader has yet to turn on the Apple, but it is written in such a way that anybody can learn from it.

Each new concept or instruction is lavishly illustrated with example screen output, so you can see what you should have produced whilst working through it. Amongst this multiplicity of pictures and examples are tutorial questions and exercises, just to make sure you have a good understanding of each chapter before progressing to the next.

Obviously, when using this book you should have access to an Apple and a version of Logo. According to the authors, there are currently only two versions of Logo for the Apple, the MJT version and Apple's own AppleLogo. There are differences between the two in operation, but this book continually shows its examples for both versions, thereby increasing its scope. I must admit I could go on and on. Suffice to say, if you want to learn Logo, go out and buy this book. **NC**

'Mastering the Colour Genie' by Ian Sinclair, published by Granada at £5.95 (paperback 148 pages).

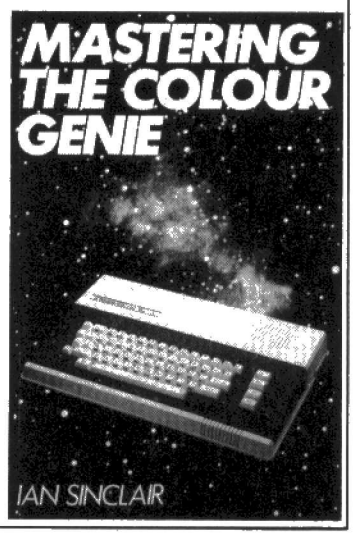
Mastering the Colour Genie is aimed primarily at the beginner, and assumes no previous knowledge of computing. The book introduces and covers the use of Basic commands that are available on the Colour Genie.

The chapters progress from using simple statements such as the variable assignment (LET), and the print statement. Small progams are nicely placed within the text to illustrate the use of the various Basic commands, and the text also explains what the program is doing, which helps the reader to understand how it works.

Chapter seven gives the reader a nice and easy introduction on producing graphics on the Colour Genie. High resolution graphics using pixels along with explanation and examples of how to use the plot and paint command are explained in a manner that shouldn't perplex.

Chapter nine is devoted to using the sound facilities that are available on the Genie. A general introduction is given on the nature of sound, along with some basic musical terminology. Example programs are given, and the reader can type these into the computer in order to hear the various tones that can be produced.

Overall this is an easy book to read, and it's well laid out. The information it contains should provide the beginner with sufficent knowledge to be able to go on to greater things. **TJ**



Clubnet keeps you in touch with enthusiasts throughout the country. It is divided into two sections — microcomputing and user groups.

We publish a list of these groups on alternate weeks. This week user groups are listed alphabetically by machine and special interest.

Each week we focus on an individual club or group with a fly-on-the-wall report. This week we feature the British Osborne Owners Group.

If your association has something special on the agenda or if you've just started a new one, contact us at *Clubnet, Personal Computer News*, VNU, 62 Oxford Street, London W1A 2HS.

The user groups listing is based on that of the Association of Computer Clubs.

Boogie with Adam

Close on one hundred people arrived at the Cavendish Conference Centre in London's West End to listen to Dr. Adam Osborne, who arrived to give a talk to members at the second British Osborne Users' Annual Meeting.

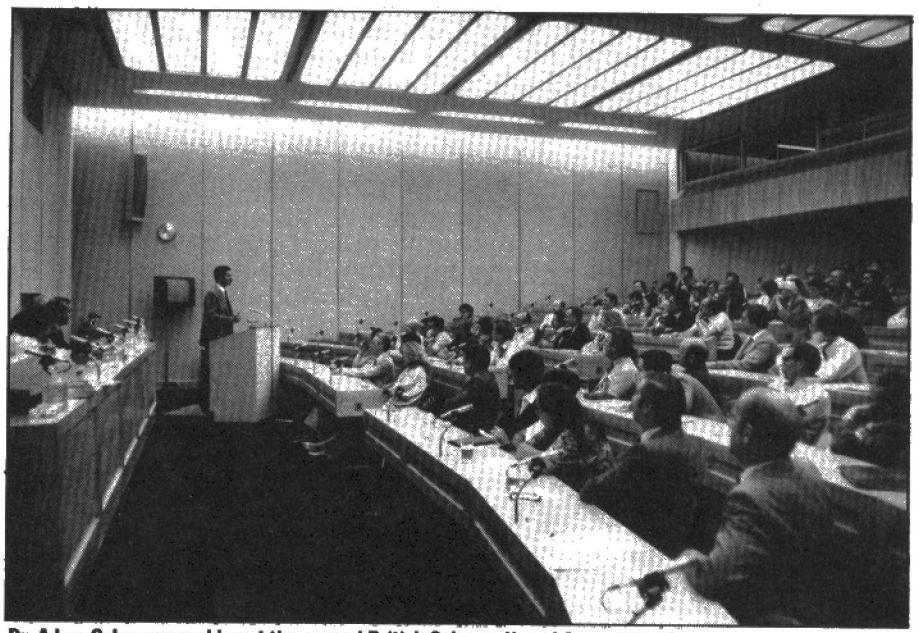
The group officially started in January this year with its first meeting in April. Organiser John Anglesea says they intend to meet quarterly, and a newsletter affectionately known as BOOGIE (British Osborne Owners Group Information Exchange) will come out four times a year.

'The next meeting will be in the form of a fair incorporating software demonstrations. It should take place at the National Liberal Club in London in the Autumn,' said Mr. Anglesea.

Future plans include presentations of particular applications such as Wordstar. Members will be encouraged to take their Osbornes along to meetings and workshops which Mr. Anglesea hopes will be set up throughout the UK.

The 300 members includes academics, doctors and journalists. Cecil Machin, chairman of management consultancy Machin Associates in Rustington, Sussex, said: 'I joined for the tips and advice — it's good to be able to talk to people who have the same kind of problems.'

An Osborne is even in use at the Society for the Protection of Ancient Buildings. One of their employees finds the Osborne very useful for organising tours, numbers for the coach, numbers for lunches, word processing, etc.



Dr. Adam Osborne speaking at the second British Osborne Users' Annual Meeting.

Dr. Osborne made it clear he doesn't exactly bust a gut to keep his company running along smoothly. 'I'm more likely to die of sunstroke than a heart attack,' he joked, after explaining his simple business philosophy — 'if people have heard of a product, they'll buy it.'

Dr. Osborne explained how he wrote a book called 'An Introduction to Microcomputers' in December 1975, only to find that no-one would publish it — so he published it himself and sold the full print run of 10,000 copies in three months.

The Osborne machine itself was launched at the West Coast Computer Fair in March 1981.

The first machine was shipped in July that year, after what Dr. Osborne described as 'a tremendous response from the computer press'.

USER GROUPS

Acorn

Coventry Acorn Atom User Group. Peter Frost, 18 Frankwell Drive, Coventry, 0203 613156.
Kent Medway Acorn User Group. Meets at St John Fisher School on last Monday of month at 7pm. Sessions at 9pm Thursday at the Fox and Hound, Chatham. Clem Rutler, c/o St John's Fisher School, Ordance Street, Chatham, Kent, 0634 42811 (day), 0634 373459 (evenings).
Manchester Acorn User Group. Meets at AMC, Crescent Road, Crupsall, Manchester 8 on Tuesday except school holidays. John Ashurst, 192 Vendure Close, Failsworth, Manchester, 061-681 4962.

Apple

British Apple Systems User Group, PO Box 174, Watford WD2 6NF.
Bristol Apple Users and Dabblers. Meets at 10 Waring House, Redcliffe Hill, Bristol BS1 6TB, once a month. Ewa Dabkowski, c/o Datalink, 10 Waring House, Redcliffe Hill, Bristol BS1 6TB, 0272 213427.
Buckinghamshire Apple User Group. Steve Profitt, The Granary, Hill Farm Road, Marlow Bottom, Buckinghamshire, 062 84 73074.
Croydon Apple User Group. Meets at Sidda House, 350 Lower Addiscombe Road, Croydon, on second Monday of month. Paul Vernon, 60 Flawkhurst Way, West Wickham, Kent, 01-777 5478.
London Apple Music Synthesis Group. Dr Davis Ellis, 22 Lennox Gardens, London SW1.
Milton Keynes Microcomputer User Group. Meets every Tuesday, 7.30pm. Brian Pain, Sir Frank Markham School, Woughton Centre, Chaffron Way, Milton Keynes.

Atari

Birmingham User Group. Meets at the Malaga Grill, Matador Public House, Bull Ring shopping centre, Birmingham, on second and fourth Thursday every month at 7.30pm. Mike Aston, 42 Short Street, Wednesbury, West Midlands.
Carshalton Atari User Club. Paul Deegan, 01-642 5232.
Hull Atari Users Local Group. Harvey Kong Til, 546 Holderness Road, Hull HU9 3ES. Hull 7911094.
London Silica Atari 400/800 User Club. Richard Hawes, 01-301 1111.
Norwich Atari User Group. Ken Ward, Norwich 661149.
Preston Atari Computer Enthusiasts. Meets at KSC Club, Merrion House, Beach Grove, Ashton, Preston, on third Thursday of month at 7.30pm. Roger Taylor, 0253 738192.

Atom

Liverpool BBC and Atom User Group. Meets at Old Swan Technical College, Room C33 on first Wednesday of month at 7.30pm and at Birkenhead Technical College on third Thursday of month at 7.30pm. Nick Kelly, 051-525 2934 (evenings).

BBC

Laserbug is an international user group for the BBC micro. Paul Barbour, 10 Dawley Ride, Colnbrook, Slough, Berks, 02812 30614.
Beebug. Sheridan Williams or David Graham at PO Box 50, St Albans, Hertfordshire AL1 2AR.
Bournemouth BBC User Group. Meets at Lansdowne Computer Centre, 5 Holdenhurst Road, Bournemouth on first and fourth Wednesday of month at 7.30pm. Norman Carey, 0202 749612.
Brent/Barnet User Group. Meets on last Sunday of month. Joseph Fox, 4 Harman Close, London NW2 2EA.
North London BBC Micro Users Group. Meets at The Prince of Wales, 37 Fortune Green Road, on Tuesdays at 7pm. Dr Leo McLaughlin, Westfield College, University of London, Kidderpore Avenue, London NW3 7ST, 01-435 0109.
Preston area BBC Micro User Group. Meets at Boatmans Arms, Marsh Lane, Preston, on last Thursday of month. Duncan Coulter, 8 Briar Grove, Ingol, Preston, Lancashire, 0772 725793.
Witham (NAMEBUG) BBC Micro User Group. Meets at comprehensive school, Witham on second Thursday each month at 7.30pm. Dave Watts 0245 358127 after 7pm.

Comal

London Comal User Group. Meets at Polytechnic of North London, Holloway, second Wednesday of month, term time. John Collins, 75 74111.

Commodore ICPUG

Barnsley. Bob Wool, 13 Ward Green, Barnsley, South Yorkshire, 0226 85084.
Blackpool. Meets at Arnold School, Blackpool, on third Thursday of month. David Jarrett, 197 Victoria Road, Thornton Cleveleys, Blackpool FY5 3ST.
Canterbury SE. Meets at The Physics Lab, Canterbury University, on first Tuesday and Wednesday of month. R Moseley, Rosemount, Romney Hill, Maidstone, 0622 37643.
Carrickfergus. David Bolton, 19 Carrickburn Road, Carrickfergus, Antrim

BT38 7ND, 09603 63788.
Cheltenham. Meets at the Cheltenham Ladies College on last Thursday of month at 7.30pm. Alison Schofield, 78 Hesters Way Road, Cheltenham, Gloucester, 0242 580789.
Clwyd. John Poole, 6 Ridgway Close, Connah's Quay, Clwyd CH5 4LZ.
Corby. Peter Ashby, 215 Wincohn Way, Corby, Northamptonshire, 05363 4442.
Coventry. Meets at Stoke Park School and County College at 7pm on fourth Wednesday of month except July, August, December. Will Light, 22 Ivybridge Road, Stvyechale, Coventry, Warwickshire.
Derby. Meets at Derby Professional Colour every other Tuesday at 7pm. Robert Watts, 03322 72569.
Durham. North-East Pet and ICPUG. Meets at Lawson School, Burnley at 7pm second and third Mondays. Jim Cocallis, 20 Worcester Road, Newton Hall Estate, Durham.
Dyfed. Simon Kniveton, 097 086 303.
Hainault. Meets at Grange Remedial Centre, Woodman Path, Hainault. Carol Taylor, 101 Courtlands Avenue, Cranbrook, Ilford, Essex.
Glasgow. Dr Jim MacBrayne, 27 Daidmyre Crescent, Newton Mearns. Glasgow, 041-639 5696.
Gloucester and Bristol Area. Meets at 23 Sheppard Leaze, Wotton-under-Edge, Gloucester, on last Friday of month.
Hampshire. Meets at 70 Reading Road, Farnborough, on third Wednesday of month. Ron Geere, 109 York Road, Farnborough, Hants, 0252 542921.
Hertfordshire North. Meets at Provident Mutual Assurance, Purwell Lane, Hitchin, on last Wednesday of month. B Grainger, 73 Minehead Way, Stevenage, Herts SG1 2HS, 0438 727925.
Kilmarnock. Meets at Symington Primary School on first and third Thursday of month at 7pm. John Smith, 19 Brewlands Road, Symington, Kilmarnock KA1 5RW, 0563 830407.
Liverpool. Meets at The Merchant Taylor School for Boys, Crosby, on second Thursday of month at 7pm. Tony Bond, 27 Ince Road, Liverpool L23 4UE, 051-924 1505.
London. Alan Birks, 135 Queen Alexandra Mansions, Judd Street, London WC1, 01-430 8025.
London North. Barry Miles, Department of Business Studies, North London Polytechnic, Holloway Road, London N7, 01-607 2789.
Norfolk. Peter Petts, Bramley Hale, Wretton, King's Lynn, Norfolk PE33 9QS, 0366 500692.
Northumberland. Graham Saunders, 22 Front Street, Guide Post, Northumberland.
Slough. Meets at Slough College on second Thursday of month at 7.30pm. Brian Jones, 53 Beechwood Avenue, Woodley, Reading RG5 3DF, 0734 661494.
South-East. Regional Group. Meets at Charles Darwin School, Jail Lane, Biggin Hill, Kent, on third and fourth Thursday of month at 7.30pm. Jack Cohen, 30 Brancaster Road, Newbury Park, Ilford, Essex, 01-597 1229.
South Midlands. Meets at 12 York Street, Stourport-on-Severn on last Thursday of month. M J Merriman at above address.
Staffordshire. 57 Clough Hall Road, Kidsgrove, Stoke-on-Trent.
Teddington. G Squibb, 108 Teddington Park Road, Teddington, Middlesex, 01-977 2346.
Watford. Meets on second Monday of month. Stephen Rabagtiati, c/o Institute of Grocery Dist. Grange Lane, Letchmore Heath, Watford, Herts, 01-779 7141.

Commodore Pet

Blackpool. West Lancashire Pet Users Club. Meets at Arnold School, Blackpool on the third Thursday of month. D Jowett, 197 Victoria Road, East Thornton, Blackpool FY5 35T.
Southern Users of Pets Association. Howard Pilgrim, 42 Compton Road, Brighton BN1 5AN.
Pet User Group Crawley. Richard Dyer, 33 Parham Road, Ilfield, Crawley.
Pet Users Education Group. Dr Chris Smith, Department of Physiology, Queen Elizabeth College, Camden Hill Road, London W8 7AH.
UK Pet Users Club. 360 Euston Road, London NW1 3BL.
Pet Users Group. Meets at North London Poly. Barry Miles, 01-607 2789.
Pet User Club. Margaret Gulliford, 818 Leigh Road, Slough Industrial Estate, 0753 74111.
Independent Pet Users Group. 57 Clough Hall Road, Kielsgrove, Stoke-on-Trent, Staffordshire.

Commodore Vic

Burnley. John Ingham, 72 Ardwick Street, Burnley, Lancashire.
London. Vic Users Group. Meets on alternate Tuesdays at 6.30pm at Polytechnic of North London, Community Centre. Robin Bradbeer.
Norfolk. J Blair, 7 Beach Road, Cromer, Norfolk, 0263 512849.

Compucolour

Caversham. Compucolour Users Group UK. Meets at Community Centre, Caversham Park Village twice a year. Peter Hiner, 11 Pennycroft, Harpenden, Hertfordshire, 05827 64872.

CP/M

Irish CP/M Users Group. Meets monthly in Dublin area. Doug Notley, Gardner House, Ballsbridge, Dublin 4, Dublin 686411.
UK CP/M Users Group. Lesley Spicer, 11 Sun Street, London EC2M 2QD, 01-247 0691.

COSMAC

COSMAC Users Group. James Cunningham, 7 Harrowden Court, Harrowden Road, Luton, Bedfordshire, 0582 423934.

Digital Equipment

Digital Equipment Users Society. The Secretary, PO Box 53, Reading, Berkshire, 0734 387725.

Dragon

Brixham Dragon Owners Club. Meets at Computer Systems (Torbay), Pump Street, Brixham, every Saturday at 2.30pm. Ian Chipperfield, 22 Brookdale Court, Brixham, Devon, Brixham 59224.

Education

Birmingham. Education ZX80/81 User Group. Eric Deeson, Highgate School, Balsall Heath Road, Highgate, Birmingham B12 9DS.
Birmingham. MUSE. National body for co-ordinating activity in schools, colleges. Lorraine Boyce, MUSE Information Office, Westhill College, Weoley Park Road, Birmingham, 021- 471 3723.
Dublin. Computer Education Society of Ireland. Dairmuid McCarthy, 7 St Kevins Park, Kilmacud, Blackrock, Co. Dublin.
Middlesex. Educational Users Group. Offshoot of National TRS-80 Users Group. Dave Fletcher, Head Teacher, Beaconsfield First and Middle School, Beaconsfield Road, Southall, Middlesex.
Worcestershire. Mini and Microcomputer Users in Education. National organisation. R Trigger, 48 Chadcote Way, Catshill, Bromsgrove, Worcestershire B61 0JT.

Forth

Forth Users Group. David Husband, 2 Gorleston Road, Branksome, Poole, Dorset BH12 1NW, 0202 764724.
Forth Interest Group UK. Meets at Room 408, South Bank Polytechnic on the first Thursday of month. K Goldie-Morrison, 15 St Albans Mansion, Kensington Court Place, London W8 5QH, 01-937 3231.

Forum
Forum 80 Users Group. Frederick Brown, 421 Endike Lane, Hull HU6 8AG.

FX-500P
FX-500-P Users Association. Max Francis, 38 Grymsdyke, Great Missenden, Buckinghamshire HP16 0LP.

Genealogists
Society of Genealogists Computer Interest Group. Anthony Camp, 01-373 7054.

Genie
Colour Genie User Group. Details of meetings/membership from Pat Doohan, secretary, Nottingham (0602) 278791.

Intel MDS
UK Intel MDS Users Group. Lewis Hard, c/o S.P.A.C.E., The Old Coach House, Court Row, Upton-on-Severn, Worcester WR8 0NS.

Ithaca Audio S100
Ithaca Audio S100 Users Group. Dave Weaver, 41 Dore Avenue, North Hykenham, Lincoln LN6 8LN.

Jupiter Ace
Jupiter Ace Users Group. John Noyce, Remsoft, 18 George Street, Brighton BN2 1RH.

Mattel
Mattel Intellivision TV Game Group. Warrington 62215 after 4pm.

Medical
Durham. Primary Health Care Group. Dr Alastair Malcolm, British Computer Society, Cheveley Park Medical Centre, Belmont, Durham, 0385 64282.
London. Medical Micro Users Group. Medicom, 1-2 Hanover Street, London W1.
Middlesex. TRS-80 Medical and Laboratory Users. Dr Robinson, The Residency, Northwick Park Hospital, Harrow, Middlesex.

Nascom
Berkshire. Nascom Thames Valley User Group. Meets at Frogmore Hotel, Windsor, on Thursday fortnightly, 8pm. Mike Rothery, 37 Eaton Wick Road, Eton Wick, Windsor, Berkshire, Windsor 56106.
Birmingham Nascom User Group. Meets at Davenports Social Club, Granville Street, Birmingham on the last Thursday of month, 8pm. Martin Sidebotham, 021-744 3093.
International Nascom Microcomputer Club. 80 Oakfield Corner, Sycamore Road, Amersham, Buckinghamshire HP6 5EQ.
Merseyside Nascom User Group. Meets at Mona Hotel, St James Street, Liverpool, on the first Wednesday of month, 7.30pm. Mr T Searle, 051-526 5256.

Newbrain
Wakefield Independent Newbrain User Group. Anthony Hodge, 15 St John's Court, Wakefield WF1 2RY.

Ohio
Ohio Scientific User Group. Tom Graves, 19a West End, Street, Somerset, 0458 45359.

Oric
Oric Owners Group. Paul Kaufman, 3 Club Mews, Ely, Cambridgeshire.

Osborne
British Osborne Owners Group. J Anglesea, Flat 19, Rowan House, Mitton Road, Handsworth, Birmingham B20 2JR.

OSI
OSI UK User Group. Richard Elen, 12 Bennerley Road, London SW11 6DS.

Pascal
Pascal User Group. Nick Hughes, PO Box 52, Pinner, Middlesex HA5 3FE.

PDP
Buckinghamshire. PDP8 User Group. Nigel Dunn, 21 Campion Road, Widmer End, High Wycombe, Buckinghamshire, 0494 714483.
Hertfordshire. PDP11 User Group. Pete Harris, 119 Carpenter Way, Potters Bar, Hertfordshire EN6 5QB, 0707 52091.

Pilot
UK Pilot User Group. Alec Wood, Wirral Grammar School for Boys, Cross Lane, Bebington, Wirral, Merseyside LG3 3AQ.

Prestel
ACC National Prestel Committee. Administrates Club Spot 800 (hobbyists on Prestel). Rupert Steele, St John's College, Oxford OX1 3JP.

Research Machines
Birmingham. Research Machines 380Z Peter Smith, Birmingham Educational Computing Centre, Camp Hill Teachers Centre, Stratford Road, Birmingham B11 1AR.
Leamington Spa. West Midland RML User Group. Spencer Instone, c/o 59 Avenue Road, Leamington Spa.
Newcastle. NERML 380Z User Group. Meets monthly at Micro-Electronics Education Centre of the Polytechnic Coach Lane Campus. Mr Hatfield or Mr Reed, Computer Unit, Northumberland Building, Newcastle Polytechnic, 0632 326002.
Oxford. Research Machines National User Group. RML, Mill Street, Osney, Oxford OX2 0BW, 0865 249866.
Oxford. Research Machines Ltd National User Group. M D Fisher, PO Box 75, Oxford OX4 1EY.

Sharp MZ80
Aberdeen. International Sharp Users Group. Graham Knight, c/o Knights Computers, 108 Rossemount Place, Aberdeen, 0224 630526.
Essex. Sharp MZ80K User Group. Joe Street, 16 Elmhurst Drive, Hornchurch, Essex RM11 1PE.
Leeds. Sharp PC1211 Users Club. Jonathan Dakeyne, 281 Lidgett Lane, Leeds LS17 3AQ.
Somerset. Sharp MZ80 Users Club. Tim Powell, Computer Centre, Yeovil College, Yeovil, Somerset BA21 4AE.

Sinclair
Brighton. ZX Users Group. J Ireland-Hill Jnr, 145 Godwin Road, Hove, Brighton.
Aylesbury. Sinclair ZX Computer Club. Ken Knight, 0296 5181.
Colchester Sinclair User Group. Meets fortnightly. Richard Lawn, 102 Pettygate Road, Colchester, Essex.
Cardiff. ZX Club. Meets on last Sunday of month, 2pm. Mike Hayes, 54 Oakley Place, Grangetown, Cardiff, 0222 371732.
Edinburgh. ZX. Meets at Claremont Hotel, Claremont Crescent, Edinburgh, on second and fourth Wednesdays every month, 7.30pm. John Palmer, 56 Meadowfield Drive, Edinburgh, 031-661 3183.
Glasgow. ZX80/81 User Group. Ian Watt, 10 Greenwood Road, Clarkston, Glasgow, 041-638 1241.
Liverpool. ZX Computer Club. Meets at ZX Computer Centre, 17 Sweeting Street, Liverpool, on Wednesday, 6.30pm. Keith Archer, 051-260 4950.
London. National ZX User Club. Tim Hartnell, Interface, 44-48 Earls Court, London W8.
London. Sinclair User Group. Meets at Polytechnic of North London, Room 2-5 Tower Block. Monday, 6.30pm. Irving Brand, Polytechnic of North London, Holloway Road, London.
ZX Spectrum Club. D Beattie, 63 Kingsley Crescent, Sawley, Long Eaton, Nottingham NG10 3DA.
Staffordshire. ZX80 National Software Association. 15 Woodlands Road, Wombourne, Staffordshire WV5 0JZ.
Suffolk. ZX Amateur Radio User Group. Paul Newsman, 3 Red House Lane, Leiston, Suffolk, SAE essential. No telephone inquiries.
Surrey. Guildford ZX80/81 Users Group. Meets Fridays. A Bond, 54 Farnham Road, Guildford, Surrey GU2 5PE, 0483 62035.
Surrey. ZX80/81 User Club. David Bigden, PO Box 159, Kingston-upon-Thames, Surrey KT2 5UQ.
West Sussex. Hassocks ZX Micro User Club. Paul King, 25 Fir Tree Way, Hassocks, West Sussex.

Sirius
Sirius User Group. Ray D'Arcy, Sirius User Club, The Microsystems Centre, Enterprise House, 7-71 Gordon Street, Luton, 0582 412215.

68XX
68XX Special Interest Group. Tim Turner, 63 Millais Road, London E11 4HB, 01-558 3681.

Software
London. Software Group. Meets at Polytechnic of North London, Room 2-3 Tower block Thursday, 6pm. Mike Duck at Polytechnic of North London, Holloway, London N7.
Oxford. Program of the Month Club. Mr Durrant, 55 St Thomas Street, Oxford OX1 1JG, 0855 250333.

Sorcerer
Liverpool European Sorcerer Club. Monthly meetings. Colin Marle, 32 Watchyard Avenue, Formby, near Liverpool L37 3JU, 07048 72137.
Surrey. Exidy Sorcerer User Group. Andy Marshall, 44 Arthurs Bridge Road, Woking, Surrey GU21 4NT.

Spreadsheet
International Electronic Spreadsheet Users Group. UK Alpha House, 7th Floor, Rowlandsway, Manchester M22 5RG.

Tangerine
Avon. Tangerine Users Group. Bob Green, 1 Marlborough Drive, Worle, Avon, 0934 21315.
Bristol. Tangerine Homebrew. A Coales, 35 Mogg Street, St Werburghs, Bristol BS2 9UB.

Texas Instruments
Leeds. TI99/4A User Group. Meets at 30 Gipton Wood Road, Leeds 8, Mondays 7pm. I Youlden, 0532 401408.
Manchester. TI User Group. T Grimshaw, 21 Allingham Street, Longsight, Manchester.
Manchester. TI9900 User Group. Chris Cadogan, Department of Computer Science, University of Manchester M13 9PL.

Triton
Triton User Group. Nigel Stride, Transam Ltd, 12 Chapel Street, London NW1, 01-402 8137.

TRS-80
Birmingham. National TRS-80 User Group. Meets at Adam & Eve Pub, 1st Floor, Bradford Street, Birmingham on last Friday of month. Michael Gibbons, 1 New Street, Castle Bromwich, Birmingham B38 9AP, 021-747 2260.
Chelmsford. TRS-80 User Group. Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.
Durham. North East TRS-80 User Group. Meets at Information Technology Centre, Gateshead on the third Wednesday of month, 7pm. J Dunn, 8 Ettrich Terrace, North Gateshead, County Durham.
Edinburgh. Scottish TRS-80 and Genie User Group. Meets at Mansion House Hotel, Milton Road, second Thursdays of month. Dick Mackie, 3 Warrender Park Crescent, Edinburgh EH9 1DX, 031-229 6032.
Isle of Wight. TRS-80 User Club. Meets at London Hotel, Ryde on last Friday of month. 7.30pm. Sean Coulson, 0903 614589.
Kent. TRS-80 User Group. Alan Reid, 22 Woodeys Road, Rainham, Kent, 0634 367012.
Bolton. Northwest TRS-80 User Group. Meets at Barton Aero Club, Barton Aerodrome, Iriam, near Manchester on last Wednesday of month, 8pm. Sub group meets at Crown Hotel, Blackfriars Street, on first and third Monday of month. Melvin Franklin, 40 Cowlees, Westhoughton, Bolton, Lancashire.
Liverpool. UK DOSPLUS User Group. Peter Toothill, 101 Swanside Road, Liverpool L14 7NL. 051-220 9733.
Liverpool. Merseyside TRS -80/Video Genie User Group. Meets second Thursday of month. 7.15pm. Peter Toothill, 101 Swanside Road, Liverpool L14 7NL. 051-220 9733.
London, SW. TRS-80 User Group. Ron Everitt on 01-394 2123.
Merseyside. TRS-80 User Group. N Rushton, 123 Roughwood Drive, Northwood, Kirby, Merseyside.
Milton Keynes. National TRS-80 and Genie User Group. Brian Pain, 24 Oxford Street, Stony Stratford, Milton Keynes.
London. TRS-80 Genie Group. Meets at Central Common Room, The Residency, Northwick Park Hospital on first Sunday of month. Dr Nick Robinson, Central Room, The Residency, Northwich Park Hospital.
Northants. TRS-80 User Group. Meets at Welwyn Park Community Centre on alternate Thursdays at 7pm. Neil Griffiths, 0858 65718.
Nottingham. East Midlands TRS-80 User Group. Mike Costello, 15 Langbank Avenue, Rise Park, Nottingham NG5 5BU, 0602 751753.

Colour Genie
National Colour Genie User Group. Marc Leduc, 46 Highbury Avenue, Nottinghamshire NG6 9DB.

UCSD
Hants. UCSD System Users Society. John Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants RG2 0QB.
Oxford. UCSD Pascal UK Users Group. Malcolm Harper, Oxford University Computing Laboratory Programming Research Group, 45 Banbury Road, Oxford OX2 6PE.

CUA
CUA User Group. Adrian Waters, 9 Moss Lane, Romford, Essex.

6502
Bedfordshire. 6502 User Group. Walter Wallenborn, 21 Argyll Avenue, Luton, Bedfordshire LU3 1EG, 0582 26927.
Hants. 6502 User Group (Southern Region). Steve Cole, 70 Sydney Road, Gosport, Hants.

Remember

Let us know about your micro club or user group so we can be sure the information printed here is up to date. Drop a card to Wendie Pearson, Listings Editor, at *Personal Computer News*, 62 Oxford Street, London W1A 2HG, or give her a call on 01-636 6890.

DATABASICS

This six-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions.

PCN keeps you up to date in three-week cycles, starting with hardware, then peripherals and finally software.

PRICE Specifications listed for each machine indicate what you get for the basic price quoted, which includes VAT.

PROCESSOR TYPE a microprocessor is the heart of the computer. The Z80 and 6502 are popular 8-bit chips. The 8088 and 68000 are common 16-bit chips. If a machine has an 8-bit and a 16-bit processor we have listed the 16-bit only. Cust. means custom-built.

SPEED IN MHz Speed of the clock used to drive the microprocessor, measured in MegaHertz (million cycles per second).

STANDARD RAM Amount of main memory used on the system. The capacity is expressed in kilobytes.

MAX RAM normally at extra cost Amount of memory to which the system can be expanded.

MAX CHARACTERS columns × lines The number of characters that can be displayed across the screen and the number of lines down.

METHOD (at extra cost) This indicates the way the computer displays information. **M** on its own means that a monitor is included in the basic price. **Tv** indicates that you can plug the computer into a television set (**M+**) indicates that the monitor costs extra. **LCD** = Liquid crystal display.

COLOUR CAPABILITY tells you whether the machine can give colour at the basic price quoted.

MAX DOT RESOLUTION gives the maximum number of points across the screen by the number of points down the screen that are available for graphics.

KEYBOARD This tells you the type of keyboard that comes with the machine. **W** = word processing, **C** = calculator and **T** = touch-sensitive.

No OF FUNCTION KEYS refers to the number of keys that can be used for different jobs by different programs.

NUMERIC PAD indicates whether the machine has a separate calculator-style group of number keys to enter data quickly.

INTERFACES BUILT-IN shows the number of standard connections built into the machine.

CASSETTE FACILITY gives a yes or no as to whether or not the machine can use a cassette to store data.

CAPACITY PER DISK AND DISK SIZE tells you how many disk drives come with the machine, and the amount of data in kilobytes (K) or megabytes (Mb) that can be stored on each drive. There are two sizes for disks, 5¼" or 8", and they can be floppy **(F)** or hard **(H)**.

OPERATING SYSTEM gives the program that looks after the general running of a computer.

LANGUAGES INC is a column which lists the programming languages that come with the machine at the basic price.

OTHER LANGUAGES AVAILABLE indicates whether or not other programming languages are available for the machine.

DISTRIBUTOR To find which company distributes the machine refer to the distributor table from the code listed in this column. The table is at the end of the listings, and gives the distributor's name and telephone number.

All details given are the latest available. We ask distributors to let us know as soon as machine specifications change so Databasics can be kept right up to date. This guide has been meticulously researched and the information collected from individual distributors listed.

PRICE GUIDE

Sinclair ZX81	£40
Casio PB100	£50
TRS-80 PC4	£50
Sharp PC1251	£80
Aquarius	£90
Casio FX702P	£90
Jupiter Ace	£90
Sinclair Spectrum	£99
Comx 35	£120
Tandy TRS-80 Pocket 2	£130
Oric 1	£139.95
Acorn Atom	£150
Atari 400	£150
TI-99/4A	£150
Colour Genie	£168
Commodore VIC 20	£170
Sharp PC1500	£170
Sord M5	£190
Dragon 32	£200
Camputers Lynx	£225
Tandy TRS-80 Colour	£240
New Brain A	£269
Multitech MPS II	£269
BBC Micro Model A	£299
Genie II	£299
Atari 800	£300
Nascom 2	£327
Genie I	£330
Commodore 64	£345
Microtan 65	£389
BBC Micro Model B	£399
Datac Micro Controller	£431
Cortex	£454
Epson HX20	£472
Nascom 3	£549
Sharp MZ80A	£549
Commodore 4016	£632
Research Machine 480Z	£650
DAI PC	£684
Apple II	£776
Commodore 500	£799
HP 75C	£883
Sharp MZ80B	£900
Apple IIe	£972
Commodore 8032	£1,129
Commodore 710	£1,144
Microdecision	£1,144
Fujitsu FM8	£1,150
Sanyo MBC 1000	£1,195
Positron 900	£1,259
Tandy TRS-80 Model III	£1,299
Commodore 8096	£1,374
Pasca 640	£1,437
NEC PC8000	£1,454
Irvine Business Systems	£1,489
Televideo TS-800 Series	£1,495
HP 86A	£1,541
Osborne I	£1,581
Signet 10025	£1,599
APL Signet	£1,610
Zenith Z89-81	£1,668
Basis 108	£1,683
Commodore Spr. Pet 9000	£1,719
Gemini Galaxy 2	£1,719
British Micro Mini 803	£1,720
Microsolution Brit. Genius	£1,840
Globe 101	£1,850
Genie III	£1,897
Toshiba T-100	£1,900
Sord M23	£1,932
Kaypro II	£1,949
Transtec BC2	£1,949
Kenilworth 83G	£1,953
Transam Truscan	£1,983
Epson QX10	£1,995
IDS Datamachine	£1,995
Tandy TRS-80 Model II	£1,999
Kenilworth 83N	£2,012
Caltext Micro	£2,019
LSIM3	£2,064
Haywood 9000 Composite	£2,064
Hawk Model 110	£2,070
Positron 9000	£2,134
Research Machines 380Z	£2,147
Superbrain JR	£2,150
Future Computers FX-20	£2,156
Comart Communicator	£2,180
Adler Alphatronic P2	£2,197
Country Com'ters C3000	£2,242
Kemitron K2000E	£2,242
Rair Black Box 320S	£2,242
Sanyo MBC 2000	£2,242
Toshiba T-200	£2,242
TMK 332	£2,242
Bonsai SM 3000	£2,294
CAL PC	£2,294
North Star Horizon	£2,294
Sanyo MBC 1250	£2,294
Casu Mini C2	£2,300
Seed System I	£2,300
Sharp PC3201	£2,300
HP 85	£2,360
HP Series 100, 120	£2,362
Sord M23P	£2,369
TI Prof. Computer	£2,386
IBM PC	£2,392
Xerox 820 Model II	£2,415
Haywood 3000	£2,439
LSM4	£2,472
Canon CX-1	£2,500
Adler Alphatronic P2U	£2,524
IO Tech Iona	£2,539
HP 87XM	£2,571
Quantum 2000	£2,587
Canon AS100	£2,633
CP1100	£2,639
Seed System 19	£2,600
Enterprise 1000	£2,645
Facit 6520	£2,645
Olympia Boss Model A	£2,645
Britannia Baby	£2,657
Adler Alphatronic P3	£2,696
Eagle II	£2,702
Almarc 801	£2,708
DEC Rainbow 100	£2,714
ICL PC Model 10	£2,754
Millbank SX10	£2,754
Olivetti M20D	£2,754
Sirius I	£2,754
Victor 9000	£2,754
North Star Advantage	£2,766
Apple III	£2,780
Sanyo MBC 4050	£2,817
Bonsai SM 4000	£2,842
Logica VTS Vitesse	£2,863
Decision-1 Computer O11	£2,869
DMS Fox	£2,875
Eagle III	£2,950
Zenith Z89-81	£2,978
Monroe EC 8800	£2,990
Philips P3500	£3,000
Tanberg EC10	£3,000
Archives 1	£3,003
Cromemco System 1	£3,025
DECPC 325	£3,080
Direct 1000	£3,093
Equator	£3,099
Clenio Table-Tops 925	£3,105
ITT 3030	£3,105
Monroe OC 8810	£3,162
HP Series 200 Model 16A	£3,211
Cifer Series 1	£3,214
Samurai	£3,214
Torch	£3,214
Sord M223	£3,277
Kontron RS180	£3,306
Columbia PC 1600-1	£3,392
Digico Prince	£3,392
OEM Orion	£3,392
Ajile	£3,400
Barcellos AMT 100	£3,450
Kalamazoo 1050	£3,450
Cromemco System 2	£3,560
Digital Microsystems 3	£3,576
Decision-1 Computer 012	£3,674
Televideo TS 1602-C	£3,714
Adds Multivision	£3,795
Clenio Pronto	£3,795
Panasonic JD800M	£3,795
Kemitron K3000	£3,795
DEC PC 350	£3,850
Vector 4	£3,852
Sage II	£4,019
Eagle IV	£4,190
C-1010	£4,197
Tandy TRS-80 Model 16	£4,199
Hytech H4500	£4,310
BMC OK 11 F800, Model 20	£4,360
ADS 42	£4,500
Televideo TS-80ZH	£4,533
Country Com'ters C1000	£4,542
Corvus Concept	£4,887
ICL PC Model 31	£4,939
Cromemco System 3	£5,170
Micro Five 1000	£5,175
Fortune 32:16 System 2	£5,204
Zeus 4	£5,400
Hawk Model 2110	£5,405
Molecular M200	£5,462
Altos 800/15	£5,663
Durango F85	£5,744
Triton 4	£5,744
Marin Chip M9900	£5,750
SW Tech. Products S0/9	£5,750
BASF 7100	£5,805
Compustar	£5,837
Sord M243	£5,842
Archives IV	£5,905
Sage IV	£5,962
ICL PC Model 32	£6,037
Rair Business Computer	£6,037
Digital Microsystems 4	£6,210
Superstar	£6,296
Racal 6000	£6,327
Eagle 1600	£6,497
TI System 200-250	£6,695
Compucorp 675	£6,780
Wicat 150	£6,846
Sundance I	£6,969
Pascal Mod. Microengine	£7,003
Diablo 3000	£7,250
Onyx 5001 MU	£7,607
Sundance II	£8,205
Haywood Hinet	£9,550
Altos 856-10	£9,631
Apple Lisa	£9,775
Micro Five 3000	£10,350
Sundance 16	£10,480
Spectrum	£11,442

ABBREVIATIONS

Ap: APL
As: Assembly
Ba: Basic
Co: Cobol
Cm: Comal
Fr: Forth
Fn: Fortran
Pa: Pascal

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Acorn Atom	£150	6502	1	2K	40K	32×16	Tv(M+)	●	256×192	W							1	●		Cassette	BaAs	●	A1	Hobbyist micro
Adds Multivision	£3,795	8085A	5	64K	256K	80×25	M		640×240	W	28		1			1			1×350K5¼F	CP/M2.2, Muon	Ba	●	A2	Multi user system
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80×24	M			W	6	●	2			1	3		2×160K5¼F	CP/M	Ba	●	T1	Good software choice
Adler Alphatronic P2U	£2,524	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×320K5¼F	CP/M	Ba	●	T1	£327 buys extra storage
Adler Alphatronic P3	£2,696	8085A	3	64K		80×24	M			W	6	●	2			1	3		2×790K5¼F	CP/M		●	T1	16 bit option-promised
ADS 42	£4,500	8085A	4	32K		40×8	M		40×8	W		●	3				3	●	1×82K5¼F	Holland Automation	Ba		A3	Intelligent cash register
Ajile	£3,400	8088	4	256K		80×25	M		640×250	W	10	●	1	1		2			2×320K5¼F	MS-DOS	BaAs	●	A9	16-bit portable micro
Almarc 801	£2,708	Z80	4	64K	512K	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M		●	A4	8-bit range goes to 20Mb
Almarc 1601	£3,445	8086	8	128K	1Mb	80×25	(M+)	●		W			2				11		2×800K5¼F	CP/M86		●	A4	Pseudo 16-bits go to 20Mb
Aquarius	£90	Z80A	4	4K	52K	40×24	TV	●	320×192	C							1	●		Cassette	Ba		M7	Competition for Uncle Sir Clive
Altos 800/15	£5,663	Z80	4	192K	208K	80×24	M			W	8	●		1					1×450K5¼F	MP/M		●	L1	Multi user business machine
Altos 856-10	£9,631	8086	10	512K	1Mb	80×24	M			W	16	●	6						2×500K5¼F	Xenix	Xenix	●	L1	The 16-bit version
APL Signet	£1,610	Z80A	4	64K		80×25	Tv(M+)*	●		*			2						2×188K5¼F	APL, CP/M	Ap	●	M1	*APL terminal recommended
Apple II	£776	6502	1	48K	128K	40×24	Tv(M+)	●	256×192	W							8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	A8	Plenty of software and extras
Apple IIe	£972	6502		64K	128K	80×24	M+	●		W					1		8			DOS	Ba	●	A8	Not an Apple II!
Apple III	£2,780	6502	2	128K	256K	80×24	(M+)	●	560×192	W		●	1				4		1×140K5¼F	SOS, DOS		●	A8	Will emulate Apple II
Apple Lisa	£9,775	68000	8	1Mb		120×30	M		792×360	W		●	2	1			3		2×860K5¼F	Lisa		●	A8	Learning time 30 mins
Archives I	£3,003	Z80	4	64K		80×25	M	●	240×100	W	23	●	2	1		1	5		2×386K5¼F	CP/M		●	S1	Standard CP/M + graphics
Archives IV	£5,905	Z80	4	512K		80×25	M	●	240×100	W	23	●	1			1	3		1×10Mb5¼H+1×7445¼F	CP/M, MP/M		●	S1	Hard disk version
Atari 400	£150	6502B	1.79	16K		40×24	Tv	●	320×192	T	3					7		●		Cassette	Ba	●	A5	Games computer, Basic extra
Atari 800	£300	6502	1.8	48K		40×24	Tv(M+)	●	320×192	W	3					7	4	●		Cassette	Ba	●	A5	Versatile, good graphics
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80×24	TvM			W	8	●	1	1		2	3		2×500K8F	CP/M	BaCo	●	B1	Up to four users
BASF 7100	£5,805	Z80A	4	64K		80×24	M			W	26	●	1	1					3×163K5¼F	BOS	Ba	●	C1	Hard disc promised
Basis 108	£1,683	6502	1	64K	126K	80×24	TvM	●	820×168	W	15	●	1	1			6	●				●	C12	Apple bus, Z80, 80 columns
BBC Micro Model A	£299	6502	1.8	16K	32K	40×30	Tv(M+)	●	320×256	W	10					1		●		MOS	BaAs	●	A1	Upgradable to Model B
BBC Micro Model B	£399	6502	2	32K		80×30	Tv(M+)	●	640×256	W	10			1		5	3	●		MOS	BaAs	●	A1	Versatile and expandable
BMC OKI if 800, Model 20	£4,360	Z80B	5	64K	256K	80×25	M	●	640×200	W	15	●	1					●	2×340K5¼F	CP/M	Ba	●	E1	Built-in printer
Bonsai SM 3000	£2,294	Z80	2	64K		80×24	M		80×24	W	14	●	1	1					2×350K5¼F	CP/M		●	B2	CP/M business machine
Bonsai SM 4000	£2,842	8088	5	128K	256K	80×24	M			W	14	●	1	1						CP/M, MP/M, MS-DOS		●	B2	Z80 for 8 bit software
Britannia Baby	£2,657	8085	6.14	64K		80×25	Tv(M+)		80×25	W	11	●	2	1					2×500K5¼F	CP/M	AsBaCo	●	B3	Cobol language included
British Micro Mimi 803	£1,720	Z80A	4	64K		80×25	(M+)		512×256	W	17	●	1	1		1			2×400K5¼F	OS/M		●	B4	This is CP/M compatible
C-1010	£4,197	6502	1	64K	128K	80×24	TvM		256×192	W	12	●	1	1		1	8	●	1×1405¼F+1×10MbH	CP/M, DOS, UCSD-P	Ba	●	C2	Apple II compatible
CAL PC	£2,294	8088	5	128K	256K	80×25	TvM	●	256×512	W		●	2	1		1	5		2×400K5¼F	CP/M	Ba	●	C3	Also Z80B Processor
Caltext Micro	£2,019	Z80A	4	64K	256K	80×24	TvM			W	36	●	1	1			3		2×400K5¼F	CP/M		●	C3	Range of software included
Camputers Lynx	£225	Z80A	4	48K	192K	40×24	Tv(M+)	●	248×256	W			1	1				●		Cassette	Ba	●	C5	Unusual — promise of CP/M
Canon AS100	£2,633	8088	4	128K	512K	80×25	M	●	640×400	W	12	●		1			4		2×640K5¼F			●	C4	Choice of CP/M86 or MS-DOS
Canon CX-1	£2,500	6809	4	128K	256K	80×24	M		80×25	W	15	●	3	1	1		2		2×320K5¼F	MCX	BaAs	●	C4	Pascal, Fortran as extras
Casio FX 702P	£90	Cust.		2K		20×1	LCD			C								●		Cassette	Ba		C6	Pocket computer
Casio PB100	£50	Cust.		0.7K	1.7K	60×1	LCD			C		●					1	●		Cassette	Ba		C6	Business pocket computer
Casu Mini C2	£2,300	Z80A	4	64K		*	(M+)		*	*			4	1			6		2×1Mb8F			●	C7	*Choose your own terminal
Cifer Series 1	£3,214	Z80	4	128K	320K	132×32	TvM			W	40	●	3	1					2×800K5¼F	CP/M		●	C17	Other models available
Clenlo Pronto	£3,795	Z80A	4	64K	1Mb	*	Tv(M+)		*	*			2	2			18		2×600K8F	CP/M	Ba	●	C8	*Choice of terminal
Clenlo Table-Top 925	£3,105	Z80A	4	64K	128K	80×25	M			W	11	●	2	2					2×600K8F	CP/M		●	C8	Watch out for the weight
Columbia PC1600-1	£3,392	8088	4.77	128K	1Mb	80×24	M	●	640×200	W	10	●	2	1			8		2×320K5¼F	CP/M, MS-DOS	Ba	●	I1	An IBM lookalike
Commodore VIC 20	£170	6502	1	5K	32K	22×23	Tv(M+)	●	176×158	W	8					3	1	●		Kernal	Ba	●	C9	Very popular home micro

Commodore 64	£345	6510	1	64K		40×25	Tv(M+)	●	320×200	W	8					3		●		Kernal	Ba	●	C9	Good value for money
Commodore 500	£799	6509	1	128K	896K	40×25	Tv(M+)	●	320×200	W	10	●	1		1	3	1	●		Kernal	Ba	●	C9	Available by summer?
Commodore 4016	£632	6502	1	16K	32K	40×25	TvM			W		●			1	1	3	●		Cassette, PETDOS	Ba	●	C9	The original PET
Commodore 710	£1,144	6509	2	128K	896K	80×25	TvM			W	10	●	1		1	2	1	●		Kernal	Ba	●	C9	Might be a long wait
Commodore 8032	£1,129	6502	1	32K	96K	80×25	TvM			W		●			1	1		●		Cassette, PETDOS	Ba	●	C9	The 80-column PET
Commodore 8096	£1,374	6502	1	96K		80×25	TvM			W		●			1	1		●		Cassette, PETDOS	Ba	●	C9	Fully expanded PET
Commodore Super Pet 9000	£1,719	6502	2	96K		80×25	TvM			W		●	1		1	1	2	●		Cassette, PETDOS	Ba	●	C9	Top of the range
Compucorp 675	£6,780	Z80	4	64K	256K	80×20	M			W	20	●	1				4		2×655K5¼F	Compucorp		●	C10	Unusual O/S
Compustar	£5,837	Z80A	4	64K		80×25	M			W		●	2						1×10Mb8H+1×350K5¼F	CP/M	Ba	●	I10	Networking system
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80×24	M			W		●	2	1			10		2×390K5¼F	CP/M		●	C13	Business CP/M micro
Comx 35	£120	1802		35K	67K	40×24	Tv	●		C								●		Cassette	Ba		C14	Built-in joystick
Cortex	£454	9995	12	64K	1Mb	40×24	Tv(M+)	●	256×192	W	12	●	1					●			BaAs		M2	Mainly sold as £340 kit
Corvus Concept	£4,887	68000	8	256K	1Mb	120×60	M		720×560	W	10	●	2			1	4			Merlin	Pa	●	K1	A4 shaped screen
Country Computers C1000	£4,542	6502	1	64K	128K	80×24	M		280×192	W	12	●	1				3		1×10Mb5¼H+1×140K5¼F	DOS, CP/M	Ba	●	C16	Runs all Apple software
Country Computers C3000	£2,242	Z80A	4	64K	256K	*	*			*			1	1					1×5Mb5¼H+1×500K5¼F	CP/M		●	C16	*Terminal own choice
CP1100	£2,639	8086	6	128K	1Mb	*	(M+)*			*			2	1			7		2×390K5¼F	CP/M 86		●	C13	Choose your own terminal
Cromemco System 1	£3,025	Z80	4	64K		80×24	(M+)	●	450×735	W	20	●	1				8		2×390K5¼F	CDOS, Crom		●	C13	Designed for business
Cromemco System 2	£3,560	Z80	4	64K		80×25	(M+)			W	20	●	1				21		2×390K5¼F	CDOS, Crom		●	C13	Large business machine
Cromemco System 3	£5,170	Z80	4	64K		80×25	(M+)			W	20	●					21		2×1.2Mb8F	CDOS, Crom		●	C13	Top end Cromec
DAI PC	£684	8080	2	48K		60×24	Tv(M+)	●	255×335	W			1					●		Cassette	Ba		D9	Optional maths chip
Datac Micro Controller	£431	Z80	2	16K		40×24	Tv(M+)		80×60	W			1			1	1	●			Ba	●	D1	Mainly used in labs
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132×24	M	●	960×240	W	20	●	2				3		2×400K5¼F	CP/M		●	D2	Competitor for IBM PC
DEC PC 325	£3,080	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				1		2×400K5¼F	P/OS		●	D2	Mini in micro clothing
DEC PC 350	£3,850	PDP11/23	N/A	256K		132×24	M	●	960×240	W	20	●	2				4		2×400K5¼F	P/OS		●	D2	Mini in micro clothing
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*			*			3	1		1			2×400K5¼F	CP/M	Ba	●	I2	*Buy your own terminal
Decision-1 Computer MDC-012	£3,674	Z80A	4	64K	192K		(M+)*			*			3	1		1			1×400K5¼F+1×5Mb5¼H	CP/M	Ba	●	I2	*You choose the terminal
Diablo 3000	£7,250	8085	3	32K	64K	80×24	M			W	8	●	1				4		2×1.8Mb8F	DACL	Ba	●	B5	Unusual O/S
Digico Prince	£3,392	Z80A	4	64K		80×25	M			W	50	●	2				7		2×400K5¼F	CP/M		●	D3	Unusual keyboard
Digital Microsystems DMS-3	£3,576	Z80A	4	64K			(M+)*			*			3			1			2×512K8F	CP/M		●	D4	*Choice of terminal
Digital Microsystems DMS-4	£6,210	Z80A	4	128K	½Mb		(M+)*			*			4						2×512K8F	MP/M		●	D4	*Depends on terminal chosen
Direct 1000	£3,093	Z80	4	64K		80×25	M		132×28	W			2						2×300K5¼F	CP/M		●	D5	Standard CP/M machine
DMS Fox	£2,875	Z80A	4	64K		80×24	M			W	16	●	3	1		1			1.2Mb5¼F	CP/M		●	D4	Portable machine
Dragon 32	£200	6809E	1	32K	64K	32×16	Tv(M+)	●	256×192	W				1		4	1	●		Cassette	Ba		D6	Tandy colour lookalike
Durango F85	£5,744	8085A	5	64K	196K	80×64	Tv(M+)			W		●	4			1	12		2×1Mb5¼F	Star Basic	BaCo	●	C3	Built in printer
Eagle II	£2,702	Z80A	4	64K		80×24	M		80×24	W		●	2	1		1			2×500K5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle III	£2,950	Z80A	4	64K		80×24	M		80×24	W		●	1						2×1Mb5¼F	CP/M	Ba	●	M3	Includes WP/SS software
Eagle IV	£4,190	Z80A	4	64K		80×24	M			W		●	2	1		1			1×1Mb5¼F+1×12.5Mb5¼H	CP/M	Ba	●	M3	Includes WP/SS software
Eagle 1600	£6,497	8086	8	128K	512K	80×25	M	●	720×352	W	24	●	2	1		1	8		1×1Mb5¼F+1×12.5Mb5¼H	MS-DOS, CP/M 86		●	M3	High speed IBM copy
Enterprise 1000	£2,645	*	8	64K			M			W	10	●	2			2			2×358K5¼F	Enterprise		●	D7	Micro Nova 16-bit
Epson HX20	£472	6301	1	16K	32K	20×4	LCD		120×32	W	13	●	2				2	●		Cassette	Ba		E2	Powerful portable
Epson QX10	£1,995	Z80	4	192K	256K	80×25	M		640×400	W	18	●	1	1			5		2×320K5¼F	CP/M	Ba	●	E2	Expansion required for Valdocs
Equator	£6,842	Z80A	4	64K	448K	80×24	M		255×560	W	14	●	7	1		1	8		1×5Mb5¼F+1×750K5¼F	CP/M, MP/M, Turbo DOS		●	E3	Two bigger models available
Facit 6520	£2,645	Z80	4	64K	128K	80×24	M		80×24	W	8	●	2						2×320K5¼F	CP/M, Facit DOS	Ba	●	F1	Concurrent printing
Fortune 32:16 System 2	£5,204	68000	6	256K	1Mb	80×24	M	●	1024×1024	W	16	●	1				20		2×800K5¼F	Unix		●	I3	Genuine 16-bit
Fujitsu FM8	£1,150	6809	1	64K		80×25	(M+)	●	640×200	W	10	●	1	1		4	1	●		Flex	Ba		S2	Good for business graphics
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80×25	M		800×400	W	20	●	2			2			2×800K5¼F	CP/M 86, MS-DOS		●	E1	Still on a promise
Genie I	£330	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W			1	1			1	●		Cassette	Ba	●	L2	Compatible with TRS 80/I
Genie II	£299	Z80	1.7	16K	48K	64×16	Tv(M+)		128×48	W	4	●	1				1	●		Cassette	Ba	●	L2	Speeded-up Genie I
Genie III	£1,897	Z80A	3.2	64K		80×24	M		160×72	W	8	●	1	1		1	3		2×700K5¼F	New DOS	Ba	●	L2	CP/M costs extra
Colour Genie	£168	Z80	2.2	32K		40×24	Tv(M+)	●	160×96	W	8		1	1		2	1	●		Cassette	Ba		L2	Home games machine
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80×25	M		160×75	W	10	●	1	1		1	5	●	2×400K5¼F	CP/M		●	G1	Low cost British system
Globe 101	£1,850	8085	3	64K		80×24	M			W	20	●	3						2×325K5¼F	CP/M		●	G4	Wordstar plus Mail Merge inc.
Hawk Model 110	£2,070	Z80A	4	64K	256K		(M+)*	●	*	*			2	1			3		2×390K5¼F	CP/M, MP/M2		●	L6	*Choose your terminal
Hawk Model 2110	£5,405	Z80A	4	64K	256K	*	(M+)*	●	*	*			2	1			3		1×390K5¼F+1×21MbH	CP/M, MP/M2		●	L6	*Choose your terminal
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80×25	M		64×255	W	34	●	2				8		2×320K5¼F	CP/M	As	●	H1	Designed for network

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Haywood Hinet	£10,982	Z80	4	64K	128K	80×24	M			W	34	●	3	1		1			1×11Mb8H	CP/M		●	H1	Large network machine
HP 75C	£883	Cust.	N/A	16K	24K	32×1	(M+)			C						1	4	●	1.3K card reader	HP	Ba		H2	Calculator/computer
HP 85	£2,360	Cust.	N/A	16K	32K	32×20	M		255×191	W	8	●	1			4	4	●		Cassette	Ba	●	H2	Engineers' machine
HP 86A	£1,541	Cust.	N/A	64K	512K	80×24	M		544×240	W			1	1		2	4			HP	Ba	●	H2	CP/M optional
HP 87XM	£2,571	Cust.	N/A	128K	640K	80×24	M		544×240	W	14	●	1	1	1	3	4			HP DOS	Ba	●	H2	Special technical uses
HP Series 100, 120	£2,362	Z80A	3.68	64K		80×24	M		80×24	W	8	●	2			1				CP/M	Ba	●	H2	Top end HP business system
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80×25	M			W	5		1		1		2			HP		●	H2	Genuine 16-bit
Hytech H4500	£4,310	Z80	4	64K	208K	80×25	M		80×25	W	26	●	1				3		2×403K5¼F	CP/M	Ba	●	H3	Standard CP/M micro
IBM PC	£2,392	8088	4.7	64K	576K	80×25	(M+)	●	640×200	W	10	●		1			5		1×360K5¼F	MS-DOS	Ba	●	I9	Slow but reliable
ICL PC Model 10	£2,754	8085	3	64K	256K	80×24	Tv(M+)			W	11	●	2				8		2×700K5¼F	CP/M	Ba	●	I4	Repackaged Rair Black Box
ICL PC Model 31	£4,939	8085	3	128K	256K	80×24	(M+)		80×24	W	11	●	4				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Multi user Black box
ICL PC Model 32	£6,037	8085	3	256K		80×24	(M+)		80×24	W	11	●	8				8		1×250K5¼F+1×5MbH	CP/M, MP/M	Ba	●	I4	Top of ICL range
IDS Datamachine	£1,995	Z80	4	64K	1Mb	*	Tv(M+)		*				2				15		2×400K5¼F	CP/M	Ba	●	I8	*Depends on terminal
IO Tech Iona	£2,539	Z80	4	69K	960K	80×24	M	●	160×75	W	12	●	1	1			8	●	2×400K5¼F	CP/M		●	I5	Good colour versatility
Irvine Business Systems	£1,489	Z80	4	64K		80×25	M			W		●	2						2×400K5¼F	CP/M		●	I6	Inexpensive CP/M machine
ITT 3030	£3,105	Z80A	4	64K	256K	80×24	Tv(M+)		80×24	W	8	●	1			1	1		2×280K5¼F	CP/M, BOS		●	I7	Top end business system
Jupiter Ace	£90	Z80	3.25	3K	51K	32×24	Tv(M+)		64×46	C		●					1	●			Fr		J1	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K		80×24	Tv(M+)		80×24	W	10		1						2×250K5¼F	Kalamazoo		●	K3	Only Kabol language
Kaypro II	£1,949	Z80	4	64K		80×24	M			W		●	1	1					2×200K5¼F	CP/M	Ba	●	C15	A portable business machine
Kemitron K2000E	£2,242	Z80	4	64K		80×24	(M+)		80×24	W			2	1			11		1×300K5¼F	CP/M		●	K4	Scientific Keyboard
Kemitron K3000	£3,795	Z80	4	64K	256K	80×24	(M+)		80×24	W		●	2				14		2×1Mb8F	CP/M, MP/M		●	K4	For scientific use
Kenilworth 83G	£1,953	Z80A	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M		●	K5	British portable
Kenilworth 83N	£2,012	Z80	4	64K		80×25	TvM		160×75	W	10	●	1	1			5		2×350K5¼F	CP/M	Ba	●	K5	Includes Basic
Kontron RSI 80	£3,306	Z80	4	64K	128K	80×25	M		256×512	W	16	●	2	1			8		2×303K5¼F	Kontron	Ba	●	K6	O/S CP/M based
LSI M3	£2,064	Z80	2.5	64K		80×24	M		80×24	W	31	●	1	1					2×200K5¼F	CP/M		●	L3	Big, British and CP/M
LSI M4	£2,472	8088	5	128K	256K	80×24	M		160×72	W	31	●	2	1			1		2×400K5¼F	CP/M 86, CP/M80		●	L3	Z80 for 8-bit software
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80×24	M	●	640×288	W	12	●	1	1			4		2×1Mb5¼F	CP/M, MS-DOS	Ba	●	L4	High-res colour graphics
Marin Chip M9900	£5,750	9900	3	64K	1.6Mb	24×80	M		24×80	W	8	●	4				12		2×1.2Mb8F	MOS, MDEX	Ba	●	M2	Genuine 16-bit
Micro Five 1000	£5,175	8088	8	128K	512K	25×80	TvM		512×512	W	20	●	10				2		2×1Mb5¼F+2×6.3Mb5¼H	*		●	F2	*Choose your own O/S
Micro Five 3000	£10,350	8086	5	128K	1Mb	25×80	TvM		512×512	W	20	●	5				3	●	1×10Mb8F	*		●	F2	*Choose your own O/S
Microdecision	£1,144	Z80	4	64K		80×24	(M+)			*			2						1×200K5¼F	CP/M	Ba,Pilot	●	I2	*Terminal extra
Microsolution British Genius	£1,840	Z80	4	64K		80×24	TvM		80×24	W	21	●	1	1					2×160K5¼F	CP/M		●	M4	'Genius' by nature?
Microtan 65	£389	6502	1	8K	48K	25×64	(TvM+)			W		●	1	2				●		Tanbug	Ba	●	M8	Expandable in many ways
Millbank SX10	£2,754	Z80A	4	65K	256K	80×25	M		80×25	W	10	●	2			1			2×350K5¼F	CP/M	As	●	M5	Scientific applications
Molecular M200	£5,462	Z80	4	64K	320K		(M+)*			*			2			1	16		1×10Mb8H+1×500K8F	CP/M	BaAs	●	G2	*Terminal required
Monroe EC8800	£2,990	Z80A	3	128K		40×24	M		240×240	W	32	●	3			3			1×320K5¼F	Monroe	BaPaPilot	●	F3	Only 40-character screen
Monroe OC8810	£3,162	Z80A	3	128K		80×24	M		80×24	W	32	●	3			2	1		1×320K5¼F	Monroe	BaPa	●	F3	Bigger model available
Multitech MPFII	£269	6502	1.2	64K		40×24	Tv(M+)	●	280×192	C				1		1	1	●		Cassette	Ba	●	S8	Apple soft compatible
Nascom 2	£327	Z80A	4	2K	64K	16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Old reliable
Nascom 3	£549	Z80	4	48K		16×48	Tv(M+)		48×96	W			1				4	●		NAS, SYS	BaAs	●	L5	Fully expanded Nascom
NEC PC8000	£1,454	Z80	4	32K	64K	80×25	M	●	160×100	W	10	●	2	1					2×300K5¼F	CP/M, NEC, DOS	Ba	●	N1	Superb colour graphics
New Brain A	£269	Z80A	4	32K	512K	80×30	Tv(M+)		640×220	C			2				1	●		Cassette	Ba		G3	A lot of promise
North Star Advantage	£2,766	Z80	4	64K		80×24	M		640×240	W	15		1				6		2×360K5¼F	CP/M		●	T9	16-bit option
North Star Horizon	£2,294	Z80	4	64K	512K		*		*	*			2	1		1	9		2×360K5¼F	North Star DOS	Ba	●	T9	*Choose your own terminal
OEM Orion	£3,392	8086	8	128K	896K	80×25	TvM		800×400	W	13	●	11				6		2×500K5¼F	CP/M 86	BaCo	●	O5	*Full communications machine.

Olivetti M20D	£2,754	Z8000	3	160K	512K	80×25	M	●	512×256	W		●	1	1			5		2×320K5¼F	PCOS	Ba	●	B6	Real 16-bitter
Olympia Boss Model A	£2,645	Z80A	4	64K		80×28	M	●	80×28	W	10	●	1				4		2×140K5¼F	CP/M		●	O1	Useful 28 lines on screen
Onyx 5001 MU	£7,607	Z80A	4	128K	256K	*			*	*			5	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	*Terminal extra; other models
Oric 1	£139.95	6502A	1	48K		40×28	Tv(M+)	●	240×200	C				1		1		●		Cassette	Ba		O2	16K promised
Osborne 1	£1,581	Z80	4	64K		52×24	M		128×32	W	10	●	1		1				2×185K5¼F	CP/M	Ba	●	O3	Portable, includes software
Panasonic JD 800M	£3,795	8085A	4	60K		80×24	M		80×24	W	21	●	3						2×250K8F	CP/M	Ba	●	P1	Larger model costs £5,002
Pasca 640	£1,437	Z80A	4	64K		80×24	M			W		●	1	1					2×250K8F	CP/M		●	W1	Regular CP/M micro
Pascal Modular Microengine	£7,003	WD9000	2	128K		*	*		*	*			4				8		2×1.2Mb8F	UCSD-P	Pa	●	P2	*Terminal extra
Philips P3500	£3,000	Z80A	4	64K	320K	80×25	M			W	11	●	2						2×0.6Mb5¼F	Turbo-DOS	Co	●	P3	Fast O/S as standard
Positron 900	£1,259	6809	1	64K	256K	*	(M+)		*	*			4		1		3			O/S 9	Ba	●	P4	*You choose your terminal
Positron 9000	£2,134	6809	1	64K	256K	80×24	TvM	●	480×240	W	12	●	4		1		3			O/S 9	Ba	●	P4	Multi user version
Quantum 2000	£2,587	Z80A	4	64K	192K	80×25	M		160×75	W	18	●	1	1			5	●	3×860K5¼F	CP/M		●	Q1	Mono, low-res graphics
Rair Black Box Model 3/20S	£2,242	8085	5	64K	512K	80×24	(M+)			*			2				8		2×1Mb5¼F	CP/M	Ba	●	R1	*VDU extra; many versions
Rair Business Computer	£6,037	8088	5	256K	1Mb	80×25	M	●		W	10	●	2			4	8		1×19Mb5¼H+1×1Mb5¼F	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit
Racal 6000	£6,327	Z80	5	64K	256K	80×26	M		80×26	W	21	●	1	1					1×600K8F	CP/M		●	R2	CP/M languages available
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40×24	Tv(M+)			W			1	1			4	●	2×144K5¼F	CP/M	Ba	●	R3	Widely used in schools
Research Machines Link 480Z	£650	Z80A	4	32K	256K	40×24	Tv(M+)			W	4		2	1		1	2	●		Cassette	Ba		R3	CP/Net version available
Sage II	£4,019	68000	8	128K	512K	*	(M+)		*	*			2	1	1				2×640K5¼F	UCSD-P System	BaAsPaFn	●	T10	*Terminal extra
Sage IV	£5,962	68000	8	128K	1Mb	*	(M+)	●		*			6	1	1				2×640K5F+1×6MbH5¼	UCSD-P System	PaBaFn	●	T10	*Terminal own choice
Samurai	£3,214	8086	4.6	128K	768K	80×25	M	●	720×400	W		●	3	1			3		2×1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics
Sanyo MBC 1000	£1,195	Z80A	4	64K		80×25	M		80×25	W	17	●	1	1					1×320K5¼F	CP/M	Ba	●	L1	Standard CP/M model
Sanyo MBC 1250	£2,294	Z80	4	64K		80×40	M		640×400	W		●	1	1					2×640K5¼F	CP/M	Ba	●	L1	High-res graphics
Sanyo MBC 2000	£2,242	8085A	5	64K		80×24	M		80×24	W	24	●	2	1			2		2×328K5¼F	CP/M	Ba		L1	Big disc model costs £3,622
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80×24	M		80×24	W			1	1					2×640K5¼F	CP/M 86	Ba	●	L1	Pseudo 16-bit
Seed System 1	£2,300	6800	2	32K	64K	80×24	M		80×24	W	3	●	2				8		2×160K5¼F	DOS 68 Flex	Ba	●	S3	Ageing business machine
Seed System 19	£2,600	6809	2	48K	1Mb	80×24	M			W	3	●	2				8		2×160K5¼F	OS-9		●	S3	Latest from Seed
Sharp MZ80A	£549	Z80	2	48K		40×25	M		80×50	W		●						●		Sharp Basic	Ba	●	S4	CP/M facility extra
Sharp MZ80B	£900	Z80A	4	64K		80×25	M		320×200	C	10	●						●		Sharp Basic	Ba	●	S4	Unusual keyboard
Sharp PC1251	£79.95	Cust.	.58	4.2K			LCD		24×1	C	18	●					1	●		Sharp Basic	Ba		S4	Pocket computer
Sharp PC1500	£170	Cust.	1.3	3.5K	11.5K	26×1	LCD		156×7	C	6	●	1	1			2	●		Cassette	Ba		S4	Optional 4-pen plotter
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80×25	M		160×50	W	10	●					5		2×500K5¼F	Sharp Basic	Ba	●	S4	Powerful Sharp Basic
Signet 10025	£1,599	Z80B	6	64K		80×24	M	●	512×512	W		●	2	1			1		2×200K5¼F	CP/M, Macnos		●	A6	Choice of keyboards
Sinclair ZX81	£40	Z80A	3.5	1K	16K	32×24	Tv		64×44	C							1	●		Cassette	Ba		S5	Sold a million
Sinclair Spectrum	£99	Z80A	3.5	16K	48K	32×24	Tv	●	256×192	C							1	●		Cassette	Ba	●	S5	Very popular home micro
Sirius I	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2		1		4		2×600K5¼F	CP/M 86, MS/DOS	Ba	●	A7	IBM style
Sord M5	£190	Z80A	4	4K	16K	40×24	Tv(M+)	●	256×196	C				1		2		●		Cassette	Ba		S6	Japanese home computer
Sord M23	£1,932	Z80A	4	128K		80×25	M	●		W	14	●	2	1		2	3		2×330K5¼F	Sord O/S, SB80	BaPips	●	S6	CP/M compatible
Sord M23P	£2,369	Z80A	4	128K		80×25	Tv(M+)	●	640×200	W	14	●	2	1		2	2		2×290K3½F	Sord O/S, SB80	BaPips	●	S6	Complete with suitcase
Sord M223	£3,277	Z80	4	64K		80×25	M			W		●	2			4			2×350K5¼F	Sord O/S, SB80	BaPips	●	S6	Standard business machine
Sord M243	£5,842	Z80	4	192K		80×25	M	●	640×400	W	15	●	4	1		4			2×1Mb8F	Sord O/S, SB80	BaPips	●	S6	Large and powerful
SW Technical Products SO/9	£5,750	6809	2	256K	1.2Mb	80×24	M			W	15	●	1	1					2×1.5Mb5¼F	Flex, Uniflex		●	S7	Top end SWTP
Spectrum	£11,442	68000	8	256K	4Mb	*	(M+)		*	*			4				16		2×720K5¼F	Mirage	Ap	●	M1	*As terminal
Sundance I	£6,969	Z80A	4	64K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine
Sundance II	£8,205	Z80A	4	128K	256K	132×24	M			W	4	●	1	1				●	1×7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance
Sundance 16	£10,480	Z8001	6	256K	1Mb	80×24	M			W		●	5	1				●	1×14Mb5¼H	BOS		●	T2	Tape backup for hard disc
Superbrain JR	£2,150	Z80	4	64K		80×24	M		560×240	W		●	2				1		2×160K5¼F	CP/M	Ba	●	I10	Bigger models available
Superstar	£6,296	Z80	4	64K		80×24	Tv(M+)		80×24				1	1			8		1×10Mb5¼H+1×400K5¼F	CP/M 80	Ba	●	B7	Includes hard disk
Tandberg EC10	£3,000	8080A	2	64K		80×25	M			W		●	7						1×250K8F	CP/M, TOS	Ba	●	T3	Very early machine
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80×24	M		80×24	W	2	●	2	1					1×500K8F	TRS-DOS	Ba	●	T4	Big business machine
Tandy TRS-80 Model III	£1,299	Z80A	2	48K		64×16	M		128×48	W		●	1	1		1		●	2×184K5¼F	TRS-DOS	Ba	●	T4	Latest TRS80
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80×24	M			W	2	●	2	1					2×1.2Mb8F	TRS-DOS	BaAs		T4	True 16-bit
Tandy TRS-80 Colour Computer	£240	6809E	1	16K	32K	32×16	Tv	●	256×192	W			1					●		Cassette	Ba	●	T4	Very popular
Tandy TRS-80 PC4	£50	Cust.	N/A	½K	1½K	12×1	LCD		12×1	C	9	●				1	1			Cassette	Ba		T4	Low-cost pocket computer
Tandy TRS-80 Pocket Computer 2	£130	Cust.	1.3	2.6K	16K	26×1	LCD		156×7	C	6	●						●		Cassette	Ba		T4	Plotter available
Televideo TS-80ZH	£4,533	Z80	4	64K		80×24	M		80×24	W	15	●	2			1			1×256K5¼F+1×7Mb5¼H	CP/M		●	C11	Recently upgraded

HARDWARE

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM — normally at extra cost	Display: Max characters columns × lines	Display: Method (at extra cost)	Display: Colour capability	Graphics: Max dot resolution	Keyboard: Type of keyboard	Keyboard: No. of function keys	Keyboard: Numeric pad	Interfaces built-in: No. of RS232	Interfaces built-in: No. of Centronics	Interfaces built-in: No. of IEEE 488	Interfaces built-in: No. of others	Interfaces built-in: No. of expansion slots	Storage: Cassette facility	Storage: Capacity per disk and disk size	Operating system	Languages inc	Other languages available	Distributor	Comments
Televideo TS-800 Series	£1,495	Z80A	4	64K		80×24	M		80×24	W	15	●	2			1				CP/M		●	C11	Standard CP/M machine
Televideo TS 1602-C	£3,714	8088	5	128K	256K	80×24	M		576×424	W	15	●	2			1			2×256K5¼F	CP/M-86		●	C11	Graphics, but no colour
TI Professional Computer	£2,386	8088	5	64K	256K	80×25	M			W	12	●		1					1×320K5¼F			●	T5	Choice of operating systems
Texas Instruments TI-99/4A	£150	9900	3.5	16K	52K	32×24	Tv(M+)	●	256×192	W						2		●		DOS	Ba	●	T5	This has sprite graphics
TI System 200-250	£6,695	9900	4	64K		80×24	M		80×24	W	12	●	1						1×5Mb5¼H	UCSD-P, PX10		●	T5	Bigger version available
TMK 332	£2,242	8085A	5	64K		80×24	M		190×96	W	22	●	2	1					2×320K5¼F	CP/M	Ba	●	P5	*6502 I/O processor
Torch	£3,214	Z80*	4/2	96K		80×30	TvM	●	640×256	W	15	●	1	1		4		●	2×400K5¼F	CPN	Ba	●	T6	CP/M compatible
Toshiba T-100	£1,900	Z80A	4	64K	96K	80×25	TvM	●	640×200	W	8	●	1	1	1		2		2×256K5¼F	CP/M	Ba	●	O4	Pro test March 18
Toshiba T-200	£2,242	8085	2.6	64K		80×24	M		80×24	W	15	●	1		1				2×256K5¼F	CP/M	Ba	●	O4	Standard CP/M machine
Transam Truscan	£1,983	Z80A	4	64K		80×24	TvM		640×288	W		●	2	1		1	5		2×190K5¼F	CP/M		●	T7	S-100 machine
Transtec BC2	£1,949	Z80A	4	64K	256K	80×24	M		80×24	W	13	●	2	1			8		2×386K5¼F	CP/M		●	T8	Fully definable characters
Triton 4	£5,744	Z80A	4	64K	160K	80×24	M			W	8	●	1	1			3		2×1.2Mb8F	MPSL-BOS		●	T11	Upgradable to Winchester disk
Vector 4	£3,852	8088	5	128K	256K	80×24	M	●	640×312	W	15	●	1	1		1	2		2×630K5¼F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit
Victor 9000	£2,754	8088	5	128K	896K	80×25	M		800×400	W	7	●	2	1			4		2×600K5¼F	CP/M 86, MS-DOS	Ba	●	D8	Same as Sirius 1
Wicat 150	£6,846	68000	8	256K	1.5Mb	80×25	M		400×300	W	20		2	1			1		2×616K5F	MCS	Ba	●	S10	Upgradable to 32 user system
Wilkes YD8110	£4,025	8086	5	128K	896K	80×24	M	●	960×624	W	21	●		1			6		2×1.2Mb8F	CP/M 86	Ba	●	W2	Standard CP/M machine
Xerox 820 Model II	£2,415	Z80A	4	64K		80×24	M		1024×512	W		●	2	2			2		2×160K5¼F	CP/M		●	R4	Powerful graphics
Zenith 120-22	£2,978	8088	5	128K	192K	80×25	M		640×225	W	18	●	2	1	1	1	5		2×320K5¼F	CP/M, MS-DOS, Z Basic		●	Z1	Graphics includes turtle
Zenith Z89-81	£1,668	Z80	2.5	48K	64K	80×24	M			W		●	2	1					1×100K5¼F	CP/M	Ba	●	Z1	Elderly CP/M machine
Zeus 4	£5,400	Z80	4	64K	320K	80×25	(M+)		80×25	W	11	●	10						1×6Mb5¼H+1×250K5¼F	CP/M, Muse	As	●	M5	Designed as multi-user

DISTRIBUTORS

A1 Acorn Computers, Cambridge 245200 **A2** Adds (UK) Ltd, 01-949 1272 **A3** Ads Ltd, 01-947 4881 **A4** Almarc Data, Nottingham 52657 **A5** Atari International (UK), Slough 33344 **A6** Anglotech Computers, Slough 74201 **A7** ACT, 021-454 8585 **A8** Apple Computers, Hemel Hempstead 60244 **A9** Anderson Jacobson Ltd, Slough 25172
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R1 Rair Ltd, 01-836 6921 **R2** Racal, Reading 782158 **R3** Research Machines Ltd, Oxford 249866 **R4** Rank Xerox, Uxbridge 51137
S1 Salmon Electronics, Darlington 721368 **S2** Stirling Microsystems, 01-486 7671 **S3** Seed, Brownhills 378151 **S4** Sharp Electronics, 061-205 2333 **S5** Sinclair Research, Camberley 681666 **S6** Sord, 01-930 4214 **S7** SWTP, Peterborough 234433 **S8** Sirtel UK Ltd, Peterborough 236010 **S9** Shelton Instruments, 01-278 6272 **S10** Software Sciences Ltd, Farnborough 544321
T1 Triumph Adler, 01-250 1717 **T2** Thames Systems, Thame 5471 **T3** Tandberg, Leeds 774844 **T4** Tandy Company, Walsall 648181 **T5** Texas Instruments, Bedford 67466 **T6** Torch Computers, Cambridge 841000 **T7** Transam Microsystems, 01-405 5240 **T8** Transtec, Bristol 277462 **T9** TRW Datacorn International Ltd, Windsor 59183 **T10** TDI, Bristol 742796 **T11** Trivector Commerce, Biggleswade 82222
W1 Westrex Ltd, 01-578 0957 **W2** Wilkes Computers, Bristol 277399
Z1 Zenith Data Systems, Gloucester 29451

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ZX81 fully expanded 16K printer hi-res 190-ZSS graphics, sound, three tracks, full keyboard, extra ROM M/C monitor cost £225 accept £145. Tel: Maidstone 831142 (eve).

BBC games to swop. Bug Byte A/Soft etc, originals only, also Atari-VCS games for sale £14 o.n.o. S/Invader, PacMan etc. Ring Danny any time 0933 673261.

Spectrum 48K four months old, £100 with instructions, games. Offers J. Miotla, 9 Merlin Way, Swindon, Wilts. Tel: 0793 25292 after 7pm (will send computer post-free).

Atari 400 16K+ Basic + Manuals, seven months old, £85 o.n.o. Tel: Mick 01-561 7042. Hayes, Middx.

Lynx 48K one month old, boxed and in mint condition, complete with tapes and newsletter £185. Tel: Swansea (0792) 891578 (evenings) require quick sale.

Sharp PC1211 with printer/cassette cradle £85. Microware disk drive for BBC Micro complete with utilities disk and cables £145. Tel: 0204 694265 (Bolton).

32K Vic 20 expandable to 40, columns (£10) +C2N drive + Super Expander + Intro Basic I+II + joystick + cover + magazines + £50 software, worth £335 accept £200 or swop for Lynx 48. Tel: 0254 37959 Lancashire, ask for Paul (after 5pm). Buyer collects.

16K ZX81, leads, manual three tapes 3D Monster Maze, Defender, Space Raiders, good condition, must sell £65 o.n.o. Tel: 01-402 8551 during evenings.

Spectrum software, Heathrow £4, 3D Tunnel £3.50, MCoder 2 £5, Horace Goes Skiing £3, Work-Force toolkit £3, Pac-Man £2, 3D Maze £2.50. 75 Hindburn Close, Doncaster.

Pet 3032 c/w cassette unit, books, software and cover etc. £325 ono. Tel: Haywards Heath 0444 454387.

Acorn Atom, 12K RAM, 12K ROM, PSU, leads, manuals, software, sound amplifier, I/O control board, 6522 VIA. Cost £210, sell for £100. Tel: Crayford (2) 529436.

Vic 20 +8K, C2N, Rat Race, Jelly Monsters, Joysticks, Boss, Kaktus, Frantic, Arcadia, Vic Revealed, excellent condition, fully boxed, only £250. Tel: St Helens (0744) 52354.

Sharp MZ80A 48K with built-in monitor and keyboard, plus two stock control programs, two Basics, manual and PEEKing book. Total value £600, will accept £450 ono. Tel: (061) 370 2038.

Sharp MZ80K software: utility, games. Sharp MZ80K 48K £199. S. Payton, The Prince of Wales Inn, Lingfield Road, East Grinstead, Sussex RN19 2EQ. Tel: (0342) 25703.

Zaxxon cassette for Atari 400/800 also Savage Island, The Count, Defender, Asteroids, ROM. Sell or swop. Tel: Mick 01-789 7058 Wimbledon, London.

TRS-80 32K Level 2 expansion interface with monitor and cassette plus Aculab floppy tape drive and Quickprinter, over £400 software, complete system, £400. Leicester 700619.

Atari 800-48K plus disk drive, plus cassette Basic £450 Pilot £45. Microsoft £40. German £15. Homefile £15. Tel: 01-310 7162 after six. Also other software.

Atari 400 (guaranteed), Basic, manuals, £85. Two joysticks, £5. Recorder, £15. Preppie, Baja Buggies and Miner 2049 'er, £12 each. Must sell. Tel: Hexham 604294.

Interton VC4000 video computer with Invaders, Pinball cassettes £50. Also hand held Invaders/Blockbuster two speeds £12. A Taylorson, 15 Yarde Avenue, RAF Catterick, Richmond, N. Yorks.

Sharp MZ-80K 48K, 18 months' old, includes books, user notes, joystick, and Epson printer interface, £190 o.n.o. Tel: Milton Keynes (0908) 677508.

Swop All my original Atari software (40 games) for an 80 col printer. Tel: 01-998 7851 any time.

Newbrain Model AD 32K with built in display includes computer manual and beginners tape £200, also Phoenix 20MHz high quality monitor £90. Tel: 01-337 9571.

Atari utilities 400/800 for sale, plus Missile Command, Pacman, Star Raiders, cartridges. Tel: 01-998 7851 any time.

Dragon 32 with tape recorder, printer lead, nearly new. First offer over £150. Also Telewriter cassette £40. Tel: 01-677 3845 (eves). London SW16.

Microvitec Cub colour monitor including leads £270. LVL dual 200K diskdrives including leads. £350. Worldwide ROM £37. All brand new. Tel: Daventry 3792.

Apple 48K Europlus, colour card, single disc drive, monitor, Silentype printer, manuals, £800. Tel: Worthing 501378.

Commodore 64 database program on cassette £10. Cheque, postal order or s.a.e. details: Mr K Hulston, 14 Bispham Avenue, North Reddish, Stockport, Cheshire SK5 6NT.

1515 Vic printer, excellent condition with box of paper £150 ono. Tel: Alton (0420) 62620 or Winchester (0962) 68085, ask for Illya.

Brand new Vic 20+ cassette + 8K RAM + joystick + loads of software + books, £160 or newish 48K Spectrum + cash or printer: 27 Day Drive, Failsworth, Manchester. Tel: 061-688 4743.

Second hand BBC software for sale, over 300 titles priced from one tenth of the cost. For full list please write to R. Battacharya, 3 Wensley Close, Harpenden, Herts AL5 1RZ.

ZX81-16K, mint, +£50 of software, 3D Defender, Star Trek, Flight Simulation, Subspace Striker, etc. £33. Tel: Paul, 021-475 3464 after 6pm except on Thursdays.

BBC one month old, 1.2/VII Basic issue 4 board. Excellent condition £385. Disk interface £85. BBC disk manual and utilities £25. View £45. All immaculate, 051-664 6568.

Vic 20 11.5K, three slot motherboard, Audiogenic Forth cartridge, £110. Tel: Beccles 715502 after 5pm or weekends.

MZ-80K twin disks drives I/O box Epson printer, interface card, 25 disks, 300 programs: disk toolkit: Word Pro, Zen. Many extras. £850 ono. D.J. Need, 92 Ewhurst Road, Crofton Park, London SE4.

The overwhelming response to PCN's Billboard service is causing delay in publication of some advertisements. To solve this growing backlog and to cover some of the publication costs we are now charging £1.50 for each ad. Every form received at PCN's offices, 62 Oxford Street, London W1A 2HG, must be accompanied by a postal order or cheque for £1.50 made payable to VNU Business Publications.

Atari 400 32K, 410 recorder, joystick, £400 worth of software including Necromancer, Sub Commander, Star Raiders, Zaxon, Astro Chase, all mint, £350. Tel: 0553 64920.

BBC B, six months old, I.2.OS plus books and Acornsoft Snapper, Monsters, Meteors, Defender, Arcadians, Rocket Raid etc. £390 ono. Tel: Derby 0382 672897 after 6pm.

Sharp MZ80A, 12 months old, immaculate condition, plus over £100 worth software, worth £600 new, accept £450 ono. Tel: Derby 0332 672897 after 6pm.

TI99/4A penfriend wanted, to swop programs and tips, send envelope containing your programs to Paul Midgley, 7 Carrington Street, Barnsley, S75 2SP. Tel: (0226) 43046.

16K Vic 20 +C2N cassette + 3K Super Expander plus 6 cartridges, over 20 cassettes, five books, excellent condition, value £600 require £300 (ono). Tel: 01-788 1753 after 5pm.

Atom fully expanded, BBC ROM fitted books, software leads £110. Tel: (090 485) 328, 4 Derwent Close, Elvington, York YO4 5AW.

Acorn Atom 12K RAM 12K ROM, complete with PSU, leads, manual, two books, software, newsletters £115 ono. Tel: 0283 216938 evenings.

Oric-1 48K, two months old, four games, two books and two cassette lead. Bargain £130. Tel: 01-554 4897 evenings.

Printer Centronics 739-2 quality printer, suit most computers, includes BBC-B screen dump, word processor, tape, boxed with manual, immaculate £290. Tel: 01-979 9102 evenings/weekends.

Micro power three channel sound add-on with amplifier, speaker and joystick ports for ZX-Spectrum £13. Five rolls of Sinclair printer paper £6. Tel: Esher 62785.

Acornsoft have a Countdown to Doom cartridge. I'll sell or swop for other Acornsoft programs. Special deals can be arranged. Tel: (0272) 683158 for details.

Atari 400/800, 48K RAM board, £65, Defender, one with instructions, £18, one without, £12. Harrison, 82 Hey Street, Spring View, Wigan, WN3 4UJ.

Atari 400 48K, six months guarantee plus Basic, Star Raiders and many cassettes, will accept best offer. Tel: 01-561 4071.

Video Genie with hi-res and sound, also feature ROM, loads of software (inc assembler and compiler). Worth £550+, sell for £300 ono. Tel: Caergwrle (0978) 761347 after 4pm.

Sharp MZ-80K 48K RAM extended Basic, green screen, manual over £100 worth software includes Wizard's Castle, Space Invaders, Scramble. £295, ono. Tel: 0522 24508 after 6pm.

Free 12K + 12K Acorn Atom with leads, manuals and PSU, plus matched cassette deck, worth £320 when buying my Atom Magic book, £175, quick sale. Tel: (0472) 48534, after 6pm.

16K ZX81 for sale, power pack, leads, manual, books, over £40 of software including Mazogs, Chess, Frogger, Backgammon, total value over £90, bargain at only £46. Tel: Lea Valley 715650 (evenings).

Wanted Vic Men, Krazy Kong or Gridd-Runner. Exchange for Arcadia, Frog or Cosmiads. Tel: Wilmslow 524284 between 4.30-6.20.

Intellivision hardly used. Voice and 14 cartridges £270, might split. Tel: Wentworth 4193.

Spectrum software including Hobbit, Penetrator, Ah Diddums, Schizoids, Arcadia, Timegate, Painter, Orbiter, Hungry Horace, Flight Simulation. Over 40. Tel: 061-881 3651 (Tony).

Newbrain A with software and beginners' guide £230, boxed and still under guarantee. Tel: Bolton 63725.

Vic 20 + cassette machine, joystick, £100, voice synthesiser £30, Super Expander £25, Sargon II Chess £15, 12 games (Rabbit etc) £30, 4 books £8. Tel: Yateley (0252) 872275.

Pet 8K OldROM, excellent condition with much software and instruction books. £180. Foster, Tel: Weybridge (0932) 47472 (evenings).

Spectrum pen-friend wanted. If you would like to exchange programs and news please write to Paul Phillips, 13 Mountain Road, Conway, Gwynedd, North Wales.

Sharp MZ80K 48K including dust cover, reset switch, three basics, games; many m/c. Speech synthesiser tape, adventures, football pools, many more £300. Tel: 01-337 1393.

Atari 48K 400 with program recorder, many books and manuals, over £150 worth of games, only £220, all in as new condition. (0455) 614830.

Mr A Sharp 12 Rainbow Close, Orpington, Kent Tel: (0689) 39809. Atari 400 16K, program recorder Basic, Jumbo Jet, Pilot, Star Raiders, Assembler, Editor De Re Atari + lots more software, manuals etc. £300 ono.

BBC games for sale, six Acornsoft games in addition to three others, all nine programs are on disk; only £39 ono. Ring Welton 61076.

Wanted Spectrum in exchange for Fidelity 2000, 40 channel CB with aerial and power supply, value £130. Tel: Sudbury (Suffolk) 75344 (evenings).

Vic 20, cassette, software, Jellymonsters, 4K RAM, joystick, Vic Revealed and much more, £1200 ono for quick sale. Tel: Luton 34889 after 6pm or weekends.

Lynx 48K, three months old, good condition, £190 ono including p&p. Write: Tony S, No. 9, Thorncliffe Roaad, Summertown, Oxford, for further details.

ZX81 1K with manual and leads, five months old, excellent condition, £25. Plus Asteroids, Gulp, Monstermaze (16K) £9. Tel: Winchester (0962) 63259 (evenings).

ZX81 +16K RAM plus leads, manual etc and software, good condition sell for £45. Tel: (0634) 220411, Ashley, Town Road, Cliffe Woods, Rochester, Kent.

Epson MX to Apple II printer interface card unused and boxed £45. Tel: 01-501 1342.

Atari 800/400 games on cassette, Zaxxon, Astro Chase, Preppie, Hazard Run, Ghost Hunter, Cross Fire, and others, 11 for £40, £5 each. Tel: 0734 67651.

Spectrum 48K + 23 games tapes, shop value £287.85, quick sale for £140. Tel: 0638 665812 evenings or write to B Houghton, 3 Warren Towers, Moulton Road, Newmarket, Suffolk.

Atari VCS £60 including two games additional cartridges £11 each. Atari 400 Pacman brand new, unused £24. Tel: 01-622 6073.

BBC Model B, disc interface, Canon Drive, utilities and games software, manuals, and leads best offer, may split. Prestel 01-373 0599 evenings and weekends.

Acorn Atom 12K RAM 12K ROM all plugs and sockets, fully expanded, £60. Boorth software, two books, almost new £195 ono. Tel: Waterlooville 54420.

100 Pet games including Chess, Star Trek, The Valley and Breakout, only £10. Tel: Southend (0702) 588601 after 5pm.

ZX81 and Spectrum tapes half price. (0272) 851337. Texas TI99/4A complete with cables and joysticks and tapes £125. (0272) 851337 Nailsea.

Learn to play good chess with my immaculate Acetronic Chess Computer with dust cover, mains adaptor, board, pieces neatly integrated into design, £30. Tel: 0234 216215.

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Tanbug VI.2 listing wanted. John Hey,10 Boscombe Avenue, Barton, Eccles, Manchester.

ZX80 books, 30 Programs, Magic Book, Hints/Tips, Pocket Book, Companion, excellent condition, bargain, all five only £10+. Borland, 51 Lovell Gardens, Watton, Norfolk.

UK101 8K RAM, 32/48 screen, 300/600 baud, Cegmon, RS-232, built into metal case, adventure games, Space Invaders, etc. All for £90. Tel: 0454 613416.

Disk drive, Siemens FDD-120, 8in SS SD/DD, good condition, with OEM manual, 19in case, CP/M manual, all £110. Please phone 0454 613416 (Bristol area).

Vic 20, 16K RAM pack, C2N cassette deck, joystick, boxed, cheap, £135 ono. Road Race cartridge, Chess, Traxx, Vicmen, Star Wars, £30. Tel: 0734 785130, you collect, near Reading.

For sale: Atari 400/800, Centipede cartridge, £20 or will swop for Asteroids or Gorf cartridge. 10 Lawton Street, Rookery, Nr Kidsgrove, Stoke-on-Trent, Staffs.

Video Genie 16K with integral cassette, manuals and leads included, best offer over £150 secures, some games to sell separately, (Asteroids, Galaxian). Tel: 031-661 1417.

Computer wanted in exchange for my audioline 40 ch. CB, power pack, SWR, meter, twig and cable. C. Anderson, 167 Malcolm Way, Knightsbridge, Livingston, West Lothian EH54 8LW.

Atari computer game with eight games and both joystick and paddle controllers, £100 ono. Only four months old. Tel: Borough Green (0732) 88-4303.

Fuller cased keyboard for ZX81, £18; Panda 16K expandable RAM for ZX81, £15; selection of 1K and 16K tapes, books, magazines etc. Tel: Cambridge (0223) 871276 evenings.

Wanted: ZX81, will pay up to £25 for 1K or £35 for 16K. Tel: Kidderminster 744956 evenings.

Pet 32K large keyboard, new ROM, with dual disk drives, and printer, Toolkit, Superchip, manuals, leads included, ideal for small business or personal use, £1,100. Tel: Windsor 58472 evenings.

Vic 20 Rat Race and Cosmiads in exchange for Gorf, Star Battle, Adventurland or Choplifter cartridges, Cosmiads cassette for Bonzo or Skyhawk. Tel: Goole (0405) 4047 after 5pm.

Nascom 1 with 48K, Hobbit microcassette drive, Zeap in Eprom, graphics, Nas-Sys, Eprom Programmer, nicely boxed, lots of documentation and magazines, £325 – might haggle! Tel: 0625 72988 after 6pm.

Wanted BBC B Com 64 unwanted Pet or Sharp MZ-80 will pay £285+. Tel: Brediland 4356 or write, Syd Mecance, 17 Meiklerigs Drive, Paisley PA2 9JN.

CB freak turned vicro freak, must raise necessary cash for a Spectrum, will sell 120 channel Home Base (including all extras), in excellent condition, £90 ono. D. Kelly, PO Box 109, Rathcole, Co. Dublin, Eire.

ZX81 16K 6 manuals and books, leads and transformer, good condition. Games: Flight Simulation, 3D, Monster Maze, bargain at £40. Tel: Brookwood 2817 (Surrey).

Dragon 32K, three months old, used once, also cassette player and manuals, everything boxed, cost £230, will accept £170 ono, bargain. Tel: 01-428 9840, ask for Sailesh.

Vic 20 Super Expander cartridge, £25 ono. Tel: 01-808 6450.

Atari VCS with 22 cartridges, cost over £675, genuine bargain at £230. Ajmel, 7 Holly Road, Northampton NN1 4QL, enclosing sae.

ZX81 16K six manuals and books, leads and transformer, good condition. Games: Flight Simulation, 3D, Monster Maze, bargain at £40. Tel: Brookwood 2817 (Surrey).

Tandy Colour Computer, large selection of software, ready to swop? South Benfleet 4965.

Pet 2001 8K integral cassette programmes, toolkit manuals, Chess, Backgammon, Tuition and other tapes. Excellent condition, £250. Tel: 01-300 8702.

Atari 800 32K plus program recorder, joysticks, manuals and various games, worth £800+, sell for £450 ono. Tel: Stevenage (0438) 723998.

Games: Spectrum Hobbit, £8; Spectrum Pimania, £6; Atari Star Raiders, £15. Tel: 041-427 1460.

Vic 20 C2N, joystick and lots of mags, sell £150, six months old. Tel: Cwmbran (06333) 64828.

Spectrum software including Hobbit, Penetrator, AhDiddums, Schroids, Arcadia, Timegate, Painter, Orbiter, Hungry Horace, Flight Simulation, Over 40. Tony. 061-881 3651.

Spectrum 48K + 23 games tapes, shop value £287.85, quick sale for £140. 0638 665812 evenings or write to B. Houghton, Warren Towers, Moulton Road, Newmarket, Suffolk.

Atari VCS £60 including two games, additional cartridges £11 each. Atari 400 Pacman, brand new, unused £24. 01-622 6073.

BBC Model B, disk interface, Canon drive, utilities and games software, manuals and leads, best offer, may split. Prestel 01-373 0599 evenings and weekends.

Wanted Vic Men, Krazy Kong or Gridd-Runner. Exchange for Arcadia, Frog or Cosmiads. Wilmslow 524284 between 4.30-6.20.

Acorn Atom 12K RAM 12K ROM all plugs and sockets, fully expanded. £60 worth software, two books almost new £195ono. Waterlooville 54420.

32K Vic 20m, expandable to 40 columns (£10) + C2N drive + Super Expander + Intro Basic I + II + joystick + cover + magazines + £50 software worth £335. Accept £200 or swap for Lynx 48. 0254 37959 Lancashire, ask for Paul (After 5pm). Buyer collects.

100 Pet games including Chess, Star Trek, The Valley and Breakout, only £10. Southend (0702) 588601 after 5pm.

ZX81 and Spectrum tapes half price. Texas TI99/4A complete with cables and joysticks and tapes £125. Nailsea (0272) 851337.

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UK101 8K RAM, 32/48 screen, 300/600 baud, Cegmon, RS-232, built into metal case, adventure games, Space Invaders, etc. All for £90. 0454 613416.

Disk Drive, Siemens FDD-120, 8in SS SD/DD, good condition, with OEM manual, 19in case, CP/M manual, all £110, please phone 0454 613416 (Bristol area).

Learn to play good chess with my immaculate Acetronic Chess Computer with dust cover, mains adaptor, board, pieces neatly integrated into design, £30. 0234 216215.

Video Genie with Hi-Res and sound, also feature ROM, loads of software (inc assembler and compiler). Worth £550+, sell for £300 ono. Caergwrle (0978) 761347 after 4pm.

Sharp MZ-80K 48K RAM Extended Basic, green screen, manual, over £100 worth software, includes Wizard's Castle, Space Invaders, Scramble, £295 ono. (0522) 24508 after 6pm.

Sharp P6 printer, friction/tractor, interface, cable, manuals £350. Reading 584497. Winbow, 102 Sherwood Street, Reading, Berks.

Spectrum educational software for sale, for infants and juniors, five stimulating games for £4.95, used once only. M Bristow, In-Vid-Ria, Route Charles, SPP, Guernsey, Channel Isles, require immediate sale.

ZX81 Gateway Guide book by Mark Charlton, £3. All 12 PCNs 50p each. Other weeklies any offers? Write J Allen, 1 Kingsfield Close, Bradford-on-Avon, Wiltshire.

Wanted 16K. ZX81 home computer plus cassettes, exchange Acetronic video games with three cassettes plus handheld Arcade Defender with everything including game speed controll. 2 Recreation Road, Southall, Middlesex UB2 5PE.

Wanted: Vic20 Super Expander cartridge, will swop Wacky Waiters, Multisound synthesiser, Amok, Space Phreeks and Blitz Cassettes for the Cartridge. Dungannon (08687) 25324.

Wanted for ZX81 a suitable tape recorder for under £20 ono. Rugby77835 after 5, M Templemum.

Spectrum software, swop Penetrator, Mined-out GB Ltd, Masterfile, Timegate etc. For Trader, Terror Dartik, Vu3D, Warlord, Dictor and other high quality 48K games. Michael 01-340 2630.

Acorn Atom, 12K RAM + 24K ROM, 5 amp PSU, all connectors and buffers, lots of software, £175. BBC conversion board, £30. 01-422 4573.

Spectrum, 50 games for sale, only £5 or swop for Penetrator, Gobble -A- Ghost or Orbiter (original tapes only). Dinnington 568580 after 4.30pm.

Tuscan S100 8K ROM Basic 64K RAM, card with 32K CMOS RAM, stereo sound card, centronic RS232 ports, £299. Upminster 24145 after 6pm.

Acorn Atom 12K + 12K with F.P, all leads and mains adaptor, some games and books, £120. 190 Thornhill, Rastrick. Brighouse 0484 717476 Philip Ambler.

Philips G 7000 as new including instruction book and five games cartridge, Pacman, Laser War, Space Monster, Billiards, £100 the lot. Hanson, 47 Quinton Road, Sittingbourne, Kent ME10 2DB.

Dragon 32 and Tandy Colour Computer Copycat. This program copies machine code tapes, send £3 and sae for a listing. Richard Hunter, 1 Great Park, Park Close, Southwell, Notts. NG25 0EE.

16K ZX81, magazines, four tapes worth £90, sell £55 (good condition). Haywards Heath (0444) 451381 after 4pm.

Dragon 31 software, Wizard War and Dragon Trek. £10 ea, also program pack 2 and Dragon selection £10, all as new. Sheffield 0742 550326.

Swap Spectrum software please. Leigh (0942) 678129 weekends.

Atari 400 software, four Atari games including, Star Raiders, £20 each, also Crypts of Terror (graphic adventure) £10 — £80 the lot. 0484 29182.

Spectrum 16K games — Mcoder (£6.50) Gulpiyan (£3), Space Raiders (£3), Artic, Microchess (£5), or £16 for all (cost over £26). Kers, Coventry 4699.

Wanted BBC (B) circuit diagrams also BBC (B) disc interface fitting instructions. Original or photostat copies. Will pay £5 each. Idris 0384 64343 (day); 021-773 2869 (Evenings).

Spectrum software to sell or swop for other software: 3D Tunnel, GB Ltd, Hungry Horace, Horace Goes Skiing, Timegate, Niteflight, Penetrator. 0279 36274.

BBC dual disc drive, Canon MD220 80-track D/sided 800K with 40/80 track switches and BBC cable. Cased with power supply, brand new, bought in error, £625. 051-644 6568. Disk and manual included.

ZX81 16K, Filesixty keyboard video invert (Switchable), keyboard beep, keyboard repeat (Switchable), software: Vu-File, Fast One, 3D Maze, City Patrol, 30 hr-Basic book, executive case. Davis 01-883 7286.

Why wait? Buy my 48K Oric-1 micro, including lots of quality software, only two months old, sell for £150 ono. 66-72793 or 01-633 3771.

BBC Model B, 100K disc drive, CRT80A cassette recorder, 10-inch B/W monitor, joysticks, software on disc, tape, + books, £700. Newent Glos (0531) 821634 evenings.

Atari VCS including 16 cartridges, open to offers over £280. 01-593 7700 after 4pm weekdays or weekends. Ask for Rod.

Arfon expansion unit for Vic20. Make your computer into a real system, seven slots for cartridges, memory, aids, etc, absolute bargain at £50 as new. Havant 486748.

Atari Video Computer System with Dodgems, Maze Craze, Asteroids, Haunted House, Indy 500 (+ Controller). All worth over £250, will sell for £125. (0202) 707840.

Casio FX602P Alphanumeric programmable calculator with FA2 cassette adaptor and programs including Flight Simulator and music, cost £95, asking £70 ono. Mildenhall (0638) 713933.

Free 12K + 12K Acorn Atom with leads, manuals and PSU, plus matched cassette deck worth £320 when buying my Atom Magic Book. £175, quick sale. (0472) 48531, after 6pm.

16K ZX81 for sale, power pack, leads, manual, books, over £40 of software including Mazogs, Chess, Frogger, Backgammon, total value over £90, bargain at only £46. Lea Valley 715650 (evenings).

Sharp MZ80K with lots of software for sale. All you need for £265, also Atari VCS with five boxed games, £120. (0202) 707840.

Sinclair ZX Spectrum 16K, as new, together with Special Invaders and Meteroids, offers around £75. 01-954 8753.

Wanted, 16K.ZX81 with a couple of games for £40. Selling Tandy TV game, 88 game variations for £15 bargain. 7 Gladstone Terrace, Whitley Bay, Tyne and Wear, NE26 2EH, ask for Paul Kelly.

Acetronic video game with Invaders, Maze Craze, Air Sea Battle, Planet, Defender and Olympics, only £50 ono. For quick sale. Ashton-in Makerfield 726456.

Wanted, Vic20 cartridge programs, only adventures needed, with instructions please. Reasonable prices paid, including postage. 021-554 8624 after 4pm, ask for Manjit.

Atari VCS as new with seven cartridges including Pacman, unique American Spacechase and new Star Raiders, all boxed as new, genuine reason for sale, only £100! Leeds 400821.

VIC20 Computer, few months old, in excellent condition, plus 3K RAM cartridge, virtually unused. Also the book Vic Revealed and owner's manual. Only £118. Macclesfield 24060.

VIC20 The Count, swop or sell, £17, also Alien Blitz £5. Rochdale 44003.

16K ZX81 computer, 4K graphics ROM, keyboard, sound board, games worth over £200, for sale for £85. Gt Yarmouth 664025.

48K Spectrum, printer, joystick amplifier, £20 worth of printer paper, software and books worth £100, cost me £400, cost you £200, good condition. (087255) 2842.

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For sale video genie (Model 1), includes £60 of software, colour board, sound unit (not fitted) and computer books, £160 ono. Bloxwich 406386.

Acetrinic MPU VCS Musicaz Games, cartridge only, £8, ono. Complete Acetronic VCS system with Invaders, Laser Blasts, Super Knockout and above, £75 ono. Borland, 51 Lovell Gardens, Watton, Norfolk IP25 6CX.

Atari VCS cartridges, Activision Kaboom, Fishing Derby, £12. Dragster, £10. Circus, Outlaw, Miniature Golf, Adventure, Human Cannonball, Basketball, Basic Programming, Basic Maths, Boxing, £10 each. Borland, 51 Lovell Gardens, Watton, Norfolk IP25 6ZX.

Sharp PC1500 pocket computer with 4K RAM plus printer/cassette interface. Cost £350, sell £225. Newmarket (0638) 665812 evenings. Mr Houghton, Warren Towers, Moulton Road, Newmarket, Suffolk.

Dragon 32K with manual Dragon joysticks, Tanoy tape recorder (with leads) and £30 worth of software. Worth approx £300, will sell for £250. Ingatestone 353524 after 4pm.

BBC ModB with joysticks, £600 of software, assembly language book and many magazines, will accept £480, negotiable. 01-833 1440 quickly!

Swop Savage Sword Conan Nos 1-7 (rare!) plus 80 Mad Magazines (mint) for ZX81. P. Mottram, 13 St John's Grove, Hull, Humberside.

Wanted ZX Spectrum 16 or 48K, must be in good condition, will pay up to £80 max. (0384) 277146.

16K ZX81, printer and four cassettes of softwares, £85 ono. 051-924 6473.

Atari 800 48K plus cassette, joysticks, £150 worth of software plus lots of magazines, only £350. 01-251 3769, after 5.30pm.

Unwanted Spectrum ZX81 software. Transylvanian Tower 3D adventure for Spectrum 48K £4, Mad Martha Spectrum £4, ZX81 Kong £3, unused, sae. A Fletcher, 11/4-27 Castlebay Drive, Milton, Glasgow, G22 7LJ.

Commordore 64 brand new, used once, two months old with direct cassette unit and software tape, value over £400, accept £299 ono. 01-570 8517 after 5.30pm.

16K RAM pack for ZX81 £6.50. 16K Galaxians, Fun to Learn inventions, History, super programs series 3, 4, 10 games. All £10. Stockton 602936.

TRS-80 16K L2 good condition, plus B/W TV and CTR-80A recorder, all leads, manuals books and loads of programs included. Price wanted only £390 ono. (Watford) 31421.

Atari VCS, 20 cartridges, new joysticks for sale or swop. Write to G. Keenan, 61 Glenfinnan Road, Glasgow G20 8JG with offer (no callers please).

ZX80, rare chance to acquire Sinclair's first! Perfect working order, boxed, mains adaptor and booklet included. Cost £100. Any reasonable offers! Emsworth 4541.

ZX81 16K, File 60 keyboard + £40 of software + mags., sell for £66 or nearest offer. (Medway) 0634 366332.

Wanted, software on the new colour Genie. Please send a list of what you have and want to sell to Steven Prior, 30 Coldcotes Avenue, Leeds LS9 6NB.

Wanted, CBM 8032/96, plus 8050 drives, plus any extras. Must be in good working condition. 01-385 2469.

Texas, T199 4A computer, plus joysticks, cassette lead, three games, etc. £120. Two months' old. (Glasgow) 041-883 1522 after 6pm.

Wanted, NewBrain Model A. 03305 269 (evenings).

Dragon 32 computer, £300 of software manuals and joysticks, etc. Games include Dragon Trek, Donkey King and more. Sale for £250. Sunbury on Thames, Middx 83156.

ZX81 Sinclair built 16K, leads, manual, Pimania etc £45. Also Black Crystal adventure for 48K Spectrum £4 or swop. Barford 624574.

Sharp MZ.80K plus software, swop for Spectrum with printer and software or BBC A/B or something similar. Poole (0202) 707840.

Osborne 1 micro CPM based single density with Wordstar, Supercalc, Basic and Software worth over £800, will accept the best reasonable offer, but don't call with silly offers. Reading (0734) 744303.

Sharp MZ80K, ideal for small business or home, integral screen and cassette with games and manual, £325. All ready to start. Poole (0202) 707840.

Vic-20 + C2N player, manual, 35 programs, all cables, worth £200: £130 ono (including p&p + insurance), all boxed. Glenboig 874204 after 5pm.

Bargain — Acetronic Chess Computer + mains adaptor, hardly used, eight levels of skill. Bedford (0234) 216215.

48K Spectrum printer, £20 of paper, amplifier, joysticks, software and books worth £100, cost me £400, cost you £200, good condition. (087255) 2842 weekdays after 4.30pm.

Seikosha GP100A printer, as new, suitable BBC, Oric, Dragon etc, with centronics interface. £175 ono. Tring, Herts (044282) 5443 (evenings).

16K ZX81 with manual and leads, also Qsave (fast load, save device, 16K in 30 seconds), plus three books and over £50 worth of software (chess, assembler, games). £65 ono. (0942) 53022.

Commodore Pet 2001, 8K, Basic 3 integral cassette and VDU, including Invaders, Golf, Database, £250. Weston-super-Mare 0934 24856.

Exchange: Tasco 3in reflector telescope, 700mm, three eyepieces, zoom lens for land use, full size tripod + sun filter. For: Vic-20 or 48K Spectrum. Michael, 5 Halton Drive, Shiremoor, Newcastle upon Tyne NE27 0SG.

Loads of Spectrum software including Hobbit, Penetrator, Arcadia, Timegate, Cruising, VU 3D, Ah Diddums, etc, etc, over 40 altogether, very cheap, first caller, £10. Tony 061-881 3651.

Wanted printer to suit unexpanded TRS80 MI LII. 29 Stencills Road, Walsall, West Midlands. Walsall 27371.

Atari Missile Command and Star Raiders cartridges plus other games, will sell or swop other games. Also wanted, Atari disk drive. Rochdale (0706) 59602.

ZX8116K + software worth £110, buyer collects. 13 games, sell £55. Mark Hudson, Eden Rise, Prospect Fields, Robin Hood Bay, Whitby, North Yorkshire.

Atari games, sell or swop, all on cassettes, C. Climber, Zaxxon, Galactic Chase, Airstrike, Ghost Hunter and more. 01-203 4545. Call after 4pm.

Commodore machine code monitor cartridge, use with Vic-20, still boxed with manual, only £15. Bude (0288) 2889.

Vic-20 cassette deck, super expander, joystick, 3K RAM expansion, toolkit, machine code monitor, books and games cartridges, all half price, £200. Fleet 20587.

Intellivision and voice, five games, Space Spartons, Lock and Chase, Space Battle, Triple Action, Blackjack, £120. Mr Webber, 11 Coronation Villas, Beaumont, Clacton, Essex CO16 0AR.

Texas TI-99/4A computer + leads and manuals, two weeks old, £90. Write to S Snell, 47 Fane Road, Walton, Peterborough. Peterborough 75291.

Commodore C2N cassette unit with counter, unused, £30. (0279) 504844 (evenings).

Video Genie, one with cassette and green screen VDU, £70 worth of software and all manuals, all for £130. Westbury 865220.

16K ZX81, learning lab, around 50K of top quality software including Flight Simulation and Frogger, worth £120, selling for £55. Ian, Penkridge 3378.

Sharp MZ80K 48K, manual, software, database, VAT accounts, good condition, delivery organised, price £220. Jaram 0482 847069 after 6pm.

Swop! My ZX81 (16K) plus £60 worth of software, magazines and books (including machine code tutor) for your Jupiter Ace. 021-472 7778.

ZX81 +16K RAM five months old, still boxed. Various software books and magazines, accept £50. Norwich 403613 (evenings).

Spectrum 16K. Spectral Invaders, Cosmos, Orbiter (Defender), over the Spectrum cassette one. Will sell £3 each or £12 lot. 01-597 1470 after 5pm.

Intellivision, four months' old, hardly used plus five games, £180 for the lot, sell to buy BBC (B) Micro. 01-889 9822 during evenings.

Sinclair ZX81 1K personal computer, five months old, with power supply, manual, etc, £30. Also high resolution graphics for 16K ZX81, £30. (0909) 564424.

Wanted BBC model A or B, software optional, any operating system, price negotiable up to £230 according to accessories, leads and manual unnecessary. York (0904) 32762 after 6pm.

Wanted Super Expander for Vic-20, must be in good and working condition, will pay £15, all offers less than £20. Contact Donald, 0851 5239 after 5pm.

Wanted BBC model A in good condition and inside guarantee, will pay £200 and also any delivery rates. Ask for Mark, Cardiff (0222) 60022.

Vic-20 joystick, £5. Vic Revealed, £5. Alien cartridge, £10, also BBC Castle of Riddles, £5. All boxed as new. Offers considered. Ashton-in-Makerfield 720984 after 6pm.

Vic 20 computer, cassette deck, Forth and Avenger cartridges, joystick, books, games, etc, £180. Ruislip 35173.

BBC software, swop Acornsoft, Program Power, Bug Byte, A&F etc, for other programs, call Ron, Tel 01-833 1440.

Vic 20 Super Expander, will swop for machine code monitor or sell £25. Stephen, Tel (0908) 604755 after 4pm.

Acetronic Chess Computer + mains adaptor, less than ten hours usage, still boxed, eight levels skill, £30 or swop for ZX81. Bedford (0234) 216215.

Oric-1 48K computer little used, complete as supplied, bargain only £145ono. Borland, 51 Lovell Gardens, Watton, Norfolk IP25 6TX.

BBC official joysticks for sale. £9 ono. Also BBC software to sell or swop, including Acornsoft and Program Power. 01-808 8906 after 6pm.

BBC software to swop. Micro power, Acornsoft, A&F and many more programs for the BBC. 0232 238373, after 3.30pm.

Atari 400/800: Submarine Commander £20 or swop for Tricky Tutorials or Eastern Front. 0343 44695 after 6pm.

Wanted battery backed RAM for Sharp PC150 (CE158). Reasonable offers please. Binysh, 26 Fernleigh Rd, Winchmore Hill, London N21 3AL.

Commodore stock control program, 32K 3000 series Pet plus disk aand printer required. Surplus original program. £100 ono. Lambert, Tel (0442) 45239.

READERS' BUY & SELL FORM

Billboard is *PCN*'s micro marketplace. Whether you are buying, selling, or swopping secondhand goods, just fill in the form up to a maximum of 24 words, including your name, address or full telephone number and send it with a cheque or postal order for £1.50 payable to VNU Business Publications, to **Billboard, Personal Computer News, 62 Oxford Street, London W1A 2HG.** But remember, this service is not for commercial advertisements; we will not include ads from companies large or small, or from anyone carrying on a profit-making business. Also, we cannot guarantee to place ads in specific issues — it's first come, first served. No reprints either unless you send in another form. Please write clearly putting only one word in each box, and remember to include your **full address and telephone number,** even if you don't want them in the ad.

PCN Billboard

Commodore CBM8032 computer and 8032 disk drive, excellent condition manuals, connectors, all included price £2,500+, selling £1,600. VJ, 021-356 6363 evenings, swop for BBC-B.

Texas Silent 700 thermal keyboard printer, 5¼in floppy disk drive, (both plug into each other, but require interface connectors for other hardware) £100. 051-928 8020.

Atari Pilot Educator (CX405) mint £50 Atari Conversational German £25. 01-310 7162 after 6pm.

Golfball typerwriter/printer with serial interface (135 baud — 15 cps). Z80 software and baud rate generator for Nascom available. £190 ono. Mike 01-874 6244.

Wanted Dragon 32, I've managed to save about £120, can you help? Tel Eaton Bray 220258.

As new, Tandy TRS-80 Colour Computer 16K, with leads and cassette recorder, four months old £200, might split. Hedges Cranford, Salisbury Rd, Sherfield English, Romsey, Hants.

Vic20 8K RAM two months old £25 ono. Derby 810239 before 6.30m or 810643 after.

Starlord (25) players, make diplomatic contact, join Alliance? Non-players requiring information about this play-by-mail game, (SSAE), P Moreland, Basement Flat C, 4 Hedgegate, Powis Terrace, London W11.

Wanted Flight Simulation programs for Spectrum 16K48K, also books or other cassettes, cash via Eurocheque or inter Post Order, W Brady, Laan Der Veren, Naties 3 4334ES Middelburg, Nederland.

Wanted Vic 20 cartridge games. Sargon II Chess, Adventure and arcade. Also wanted C2N cassette unit in good order. 01-789 1519, ask for Bob or leave phone number.

Texas TI99/4A owner will buy used games: arcade type; flight simulator, space games, must have good graphics, sound, send info to Mr Cooke, 46 Hooks Lane, Thorngumbald, Hull HU12 9PZ.

Acorn Atom 16K ROM 12K RAM with utility monitor ROM floating point ROM plus books, manuals and over £60 software, tapes £160 ono. Dave (0788) 812940, evenings only.

Database TV game and six cartridges including Space Invaders, Road Race and Space Battle, colour and sound, joysticks and adaptor, all for £45 ono. 01-675 2701.

Acorn Atom 1/2MHz, 12K RAM 12K ROM 6522 and FP ROM printer interface, all manuals and leads, software includes Frogger, Galaxians, Pacman, Invaders, Space Panic, Defender, Zodiac, will sell £100. (0487) 841064.

Acorn Atom, 12K ROM 12K RAM includes, manual, new power pack, all leads games books, all for only £99. Manchester 061-428 2769.

TRS80 software Visicalc, Quickpro+ program generator, word processor, budget management, memory information, newDOS+ Basic, pools systems, disk, cassette, s.a.e. list. 104 Ashurst Road, Cockfosters, Barnet, Herts. 01-449 2909.

TRS80 Level II 48K dual disks cassette. RS232 lower case, manuals, monitor plus software Visicalc Quikpro+ NewDOS+ etc, worth over £2,000. £950 ono. 01-449 2909.

Atari VCS with joysticks, paddles etc. and Combat, Space War and Dishing Derby. Bargain at £90. (09654) 3317. (after 5pm).

BBC Model-B utilities: link-editing, consolidation with subroutine libraries; Basic virtual memory allowing unlimited program sizes; etc. Disc-based, Basic-2, £17.50. C Gouyon, 51 Codenham Straight, Basildon, Essex SS16 5DJ.

BBC software, swop Acornsoft Salamander, Program Power, A&F, and many more, call Ezra 01-458 6440 evenings.

Texas T199/4, hardly used, still with box, ideal for learning on, with comphrehensive leaners manual. Wrexham 758653 (evenings).

Acorn Atom 12K RAM, 12K ROM, tool box ROM books, listing approx. 20 programs on tape, power supply and leads, £170 ono. Oxted 4819.

Vic-20 with cassette unit, Atari joystick and over £50 worth of games software, would cost over £220, will sell for £160. Hassocks 3857, after 4.30pm.

ITT Apple 2 32K, disk and cassette interfaces, fully Apple compatible, assorted software and manuals, recently serviced, sadly it must go so only £280. Ian Harrison, Llanberis (Wales). 872295.

Acorn Atom 12K ROM 12K RAM PSU, leads, Magic Book + £50 worth of software inc GalaxiaS, Star-Trek, 747 Space Panic, Scramble etc. £120. Derby (0332) 514033.

16K ZX81 with quality cased keyboard, large software library, six books, compiler and assembler, worth over £200, will accept first offer over £80. 0326 312463.

Wanted Vic 20, willing to pay up to £100, £120 with cassette deck. 051-428 5169; 161 Grange Lane, Gatterre L25 5DY, England, 4.30.

Oric-1 48K as new, two months old plus mind games, graphics demo progs. £120 ono. 047 553 368.

Atari VCS, 20 cartridges, new joysticks and cartridge rack, cost £600+, sell for £200 (will not split), or will exchange for Atari 800 48K. 041-946 9110.

Olivetti Praxis 35 electronic daisy wheel typewriter, this is not fitted with interface, still under guarantee £210 ono. J. Parish, 2 Collyers Close, Darlington, Co Durham DL2 2ES (letters only).

Sharp MZ-P5 printer as new £210 or nearest. J. Parish, 2 Collyers Close, Hurworth, Darlington, Co Durham DL2 2ES, letters only please.

Wanted. Dragon 32K computer plus joysticks. Harlow (0299) 415409 after 6m, ask for Michael.

Printer ICL KSR RS232 300 baud, full ASCII set, tractor feed, upper and lower case, 120 column typewriter, quality print, ideal for word processing. £175. 0252 877174.

ZX81 16K with manual, leads and three tapes, Defender, Monster Maze, Raiders. Good condition, £65 ono must sell! 01-402 8551 evenings.

Vic 20 games Ratrace, Super Lander, Chess £10 each; Kosmic-Kamikaze, Space Panic, Back Gammon, £4 each; send sae to T. Cannell, 14 Parkstone Ave, Bristol BS7 0BY. Don't miss this amazing offer!

Spectrum RAM pack (32K) for sale (issue one only) £15, also some software. Richard, Tel 01-622 3870 after 8pm.

Wanted: Pet 2001 for Spectrum 16K, cassette deck, (both new) and games book. Southampton (0703) 556823 (eves).

Atari VCS with extra paddles and keyboard controllers, complete with Combat, Asteroids, Road-Race, Adventure Air-Sea Battle and Basic, will swop for Lynx 48K or Dragon 32. 01-373 5221.

1K-ZX81 — £35, keyboard + case £30, I/O port £5, books £2 each, software 1K-£1.50, 16K-£2.50, or swop all for Atari 822 printer. 01-584 1151.

Sinclair 16K ZX81; complete with all leads and manuals etc, plus one book, cost £100+, quick sale for £45, ono. Oxford (0865) 772542.

Sharp MZ80K 13 months old, integral screen and tape, instruction manual and some tapes, £250. Formby 07048 75063 after 5pm.

ZX81 16K, professional keyboard, Programs including Mazogs, Trader, Chess, Flight Simulation and many more. Seven ZX magazines, all worth £180, selling for £80, Tel: 01-254 5952 (evenings).

Acorn Atom 12K RAM, 12K floating point ROM + Ross Eprom with 33 extra commands, also includes £70 worth of top quality software, price £140. Wolverhampton 700739.

Atari VCS with Combat, Space Invaders, Asteroids, Indx 500 cartridges, joysticks, paddles included, £100. Belfast 703036 (Northern Ireland, after 4.30pm on weekdays only).

Atari games on cassette for sale or swop. 021-520 8717 (early evenings if possible).

Atari VCS plus 14 cartridges with joysticks and paddles, £120 ono, will not split. Ruislip 37284.

Atari, swop Zaxxon, Protector, Astro Chase, Preppie, Air Strike, Sea Dragon for Miner 2049ER, Choplifter Shamus, Apple Panic. Offers. 051-220 8927.

Atari 400 16K, 410 recorder, both under guarantee, Basic plus manuals, joysticks, Star Raiders, Preppie, Airstrike and membership of software library, £225. Highcliffe (04252) 72271.

Atari 400 Basic assembler and Star Raiders cartridges, 410 program recorders, joystick, £195, perfect condition. 027588 5040.

Wanted Atari 810 disk drive, and 48K RAM module, please write to Gary Tinsley, 6 Bradwall Road, Sandbach, Cheshire CW11 9AB stating price etc.

Atari 400 cassette recorder and £250 worth of software including Pacman, Star Raiders and Missile Command. Whole system worth over £500, will accept £375. Buyer collects. Dunstable 602617 (weekday evenings).

Atari software to swop or sell, various cassettes and cartridges, all perfect condition. Metheringham 0526 21187 (after 6pm).

Wanted Atari computer 400, swop Murray CBH1500 plus SWA Meter Coxel Cable, Mike; Aerial 7ft. Also want Atari cassettes. 01-267 5295.

Atari 400 games for sale, Empire of the Overmind, Airstrike, Savage Islandi, £10 each, all with full instructions, as new. Rock (0299) 266136.

Atari 400 with program recorders, Basic cartridge, 2 joysticks, also 3 manuals and Star Raiders, Missile Command and Pacman cartridges. Worth over £400, accept £250. J. Trainor, 1 Park Drive, Littleover, Derby DE3 6FY.

Atari computer games, swop Asteroids, offered with instructions for Jumbo Jet Lander or Miner 2049ER. Offers considered (48K Disk/Cassette). 021-705 4340.

Atari 400 computer complete with Basic, joysticks, cassette recorder, various games, only five months old, £195. Sunderland 263251.

Atari 400 including Basic plus joysticks, paddles etc. £200 worth of software, e.g., Star Raiders, Sub Command, will accept £195 ono. 0786 2370 (days), 0324 812935 (evenings).

Atari VCS plus 15 cartridges, all hand controls, including keypads, £250 ono. 01-749 6233 (6-8pm).

Atari VCS with Combat cartridge, six months old, £55 ono. Also Asteroids, £15. Space Invaders, £12. Night Driver, £12 cartridges. 021-358 1010.

Wanted — Arrow Chip 15. Anyone willing to sell me one — please contact Richard on 0742 25596 (days).

BBC A or B wanted, will buy or swop with Vic 20, cassette unit, joystick, 16K RAM. Games worth £50. Difference paid. S. McGowigle, 15 Nelson Street, Skipton.

BBC Jeremy Ruston Compiler, £20 or swop Level 9 software. Julian — 01-435 1738 (after 6pm).

BBC enthusiast wishes to swop Seikosha GP100A graphic printer, cable and software for any BBC disk drive, directly BBC compatible printer. Cost new £247. James — (0226) 41753.

BBC Model B, disk interface, Canon drive, three months old, manuals, software, tapes, disks, utils, games, £650 ono. May split. 01-373 0599 (evening/weekend).

BBC Model B, disk interface, BBC recorder, Seikosha GP100A printer, most Acorn soft and superior software, little used. Emigration forces reluctant sale, £575 ono. May split. Steve — 01-668 8342.

BBC 32K games cassette with six programs, Pontoon, Poker, Bridge, Hangman, Simon, Sliding Squares Puzzle, all model colour graphics, only £4 for all six. Kawal Banga, 46 Derby Lane, Derby DE3 8UA.

For sale, BBC Model B, £335. Tandy line V11 printer, £165. Both for £475. Joe Griffin — Crewe 820213.

Arom BBC 16K ROM + 4K Eprom BBC Basic PC board for Atom with instruction booklet, £35. 01-363 6075.

Sharp MZ80K, 48K RAM, green screen, manuals and games, plus MZ80A Basic included, as new, buyer collects, £325. 0702 330015 (Southend).

Sharp MZ80K software, first class original games, Exocet Missile Attack, Panzer Tank Apollo and many more. Also proven business packages, tape or disk. 0789 840088/205590.

Sharp MZ80K, interface, printer and disks, plus loads of software, £999 or will split, disks suitable for MZ80A or MZ80B. Steve — Basingstoke 771247.

Sharp MZ80K micro 48K, complete with Basic tape and some games, has seen little use — gone up to bigger system, price £325. Lincoln 722292.

Spectrum software tape for sale, contains Time Gate Hobbit VU-3D, Rescue, Penetrator, Orbitor, Flight Simulator, Gulpman. All for £15. 0259 214374 (evening/weekend).

Wanted Spectrum 48K in exchange for 10 speed Tour de France Raleigh Racer, as new, can deliver anywhere. 076 46 2522.

16K Spectrum, brand new, un wanted gift, still in box. Also software worth £30. Will accept £100. Mr MacNiven, 089 684 249 (after 5pm).

48K Spectrum + printer, + six rolls of paper, + £140 worth of software. Also £20 worth of books. Together woth £400. Sell for only £235. Paul — 061-973 2229.

Spectrum software copier, £2.45, makes backup copies of your precious software, easy to use. For personal use only — 16K/48K. J R Briggs, 33 Wessex Gardens, London NW11 9RS.

Spectrum, software, sell or swop, silversofts Ground Attack, new, unwanted gift, Richard after 5.30pm, 080428-321.

Specrum software, Hobbit £11, Arcadia £4, Galaxians £4, Hobbit includes instructions and the book. Huddersfield (0484) 661403, also Krazy Kong (48+16K versions) £4.

Specrum 16K Manuals Psion Simclair Video Hewsons software, little used £80. devizes (0380) 3341.

Spectrum club, anyone interested in starting Spectrum sotware exchange club (16/48K) send sae and list of progs to Paul Ockenden, 61 Albourne close, Brighton.

Spectrum software: swop or sell, 3D Tanx, Joust, Horace Goes Skiing, Galaxians, Cruising, Blind Alley, Meteor Storm, Spectres, Spectral Invaders, Sea War . . . Steve on 01-452 9436.

Acorn Atom 1/2 MH3, 12K RAM, 12K ROM, 6522 and FP ROMs printer interface, all manuals and leads, software includes Frogger, Galaxians, Pacman, Invaders, Space Panic, Defender, Zodiac, will sell £100. (0487) 841064.

If it's worth doing ONCE . . .

ICL, with understandable pleasure, has announced in the last week that it has been awarded a validation certificate for its Pascal offering.

Meanwhile in Hobart, Tasmania, Professor Arthur Sale, a leading figure in the development of the Pascal Validation Suite, has been closely involved in persuading manufacturers to go for certificates.

His list of successes includes several household names. One occurs more than once, because more than one of its departments has obtained such certificates.

The name is ICL.

Another micro first?

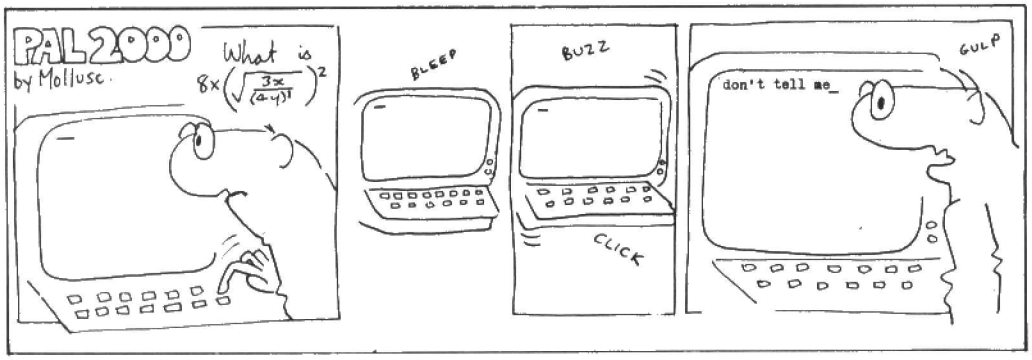
Southampton-based Quicksilva is flying the flag abroad. It has written to *PCN* saying it has 'become the first British Software House to establish a North American operation'.

Several British software houses will be surprised to learn that Quicksilva has achieved this remarkable first. Some of them (with no great success, admittedly) have operated in North America at various times over the last decade.

Perhaps Quicksilva meant to say it had become the first British software house to establish a North American operation this week, month, or even summer?

NEXT WEEK

- **Hardware — We look at the communicating Mupid micro from Austria.**
- **Peripherals — A full Pro-Test of a new colour plotter for the IBM PC.**
- **Software — We compare two Spectrum versions of Forth.**
- **Gameplay — Software fantasy for the Atari, Commodore 64, Spectrum and Oric.**
- **Micropaedia — CP/M is the subject of this pull-out guide.**



SYNTAX ERRORS

Bonus! Extra

We did an injustice to Intex Datalog's new payroll system for the Commodore Pet last week when we said it was designed for up to 25 employees. Well, it may be a package for small business — but not that small. In fact, Bonus! will cater for up to 250 employees . . . sorry.

Number up?

Another dropped digit error! MCP, the company with the Oric joystick interface and speech synthesiser (Routine Inquiries, issue 19) is on 0792-844465.

Vic too quick

In our round-up of word processing packages for the Commodore 64 issue 16, we reviewed Quick Brown Fox for the Vic 20 on the understanding it was virtually the same as the not yet released version for the Commodore 64. But we now know that's not the case.

We'll try again, though, when we get the proper Quick Brown Fox 64 version.

PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

Organisers who would like details of coming events included in PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
8th ZX Microfair	August 20	Alexandra Palace, London	Mike Johnstone, 01-801 9172
Acorn User Exhibition	August 25-18	Cunard International Hotel, London	Computer Marketplace Ltd, 01-930 1612
Computer Open Day	September 1	Draganora Hotel, Leeds	Tony Kaminiski, Couchmead Communications Ltd, 01-778 1102
Video, Audio and Computer Show	Sep 16-18	Bradford Exposition Centre	R. Cooper, J. Wood & Sons Ltd, Bradford 720014
Home Entertainment Show	Sep 17-25	Olympia, London	Montbuild Ltd, 01-486 1951
Computer Open Day Exhibition	September 22	Central Hotel, Glasgow	Couchmead Communications Ltd, 01-778 1102
Microcomputers in Business	Sep 27-29	Warwick University, Coventry	Peter Bubb, 01-892 4422
Personal Computer World Show	Sep 29-Oct 2	Barbican Centre, London	Montbuild Ltd, 01-486 1951
Computer Fair	Oct 2	The Sir Frederic Osborn School, Welwyn Garden City	R Brown Welwyn Garden City 23367
European Computer Trade Forum	Oct 4-7	NEC, Birmingham	Clapp & Poliak Europe Ltd, 01-747 3131

OVERSEAS

Event	Dates	Venue	Organisers
International Micro Computer Exhibition	Aug 2-5	Kuala Lumpur, Malaysia	Conference & Exhibition Management Services SDN BHD, 9-A Jalan SS24/8 Taman Megah, Petaling Jaya, Selangor
National Computer Business & Office Systems	Aug 16-19	Auckland, New Zealand	Trade & Industrial Exhibitions, 12 Heather Street, Parnell, PO Box 9682, Auckland
Personal Computers & Office Automation Systems Exhibition	Sep 5-8	Amsterdam, The Netherlands	RAI Gebouw BV, Europaplein 2, 1078 GZ, Amsterdam
Australian Computer Exhibition	Sep 13-16	Melbourne, Australia	Riddell Exhibition Promotions PTY Ltd, 166 Albert Road, South Melbourne, Vic 3205
International Peripheral Equipment & Software Exposition	Sep 13-15	Moscone Centre, Anaheim, USA	Cahners Exposition Group SA, 0483 38085

Announcing more exciting programs for the BBC.

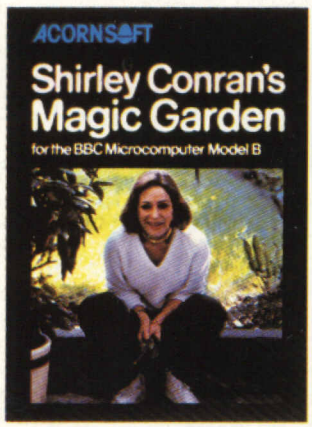
Acornsoft is the software division of Acorn Computers, the company that designed and built the BBC Microcomputer. Here are four more exciting programs, all designed to get the most from your BBC Micro.

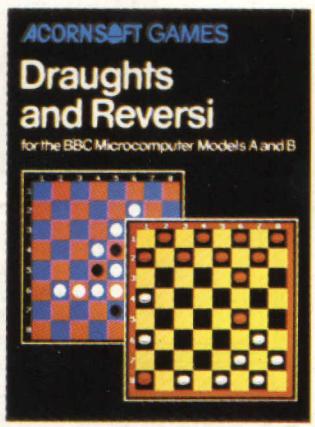
Magic Garden (£9.95) is a cassette based on Shirley Conran's successful book. It's a problem-solving program which provides the complete beginner with instant answers to the questions of what to plant and where. Simply tell the computer whether you prefer a shrub or a flower, the type of soil, light and shade conditions and required flowering time and the computer will come up with a selection of possible plants.

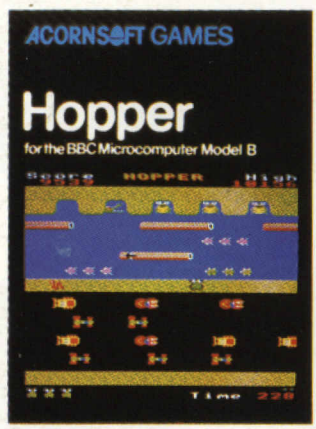
Draughts & Reversi (£9.95) is a cassette containing two traditional board games for you to play against the computer. Both give a graphic display of the board on the screen and you can enter your moves with either keyboard or joystick. The games can be played at varying levels of difficulty and on the higher levels you will find the computer to be a very worthy adversary.

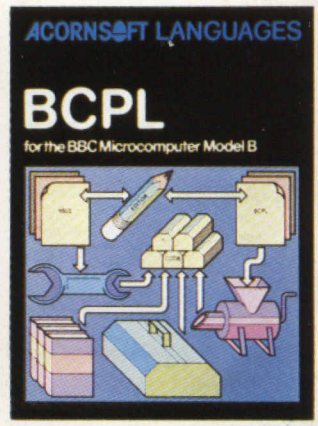
Hopper (£9.95) is a game on cassette which can be played with either keyboard or joysticks. Hop the frog across the busy motorway trying to avoid four lanes of fast-moving traffic. To get across the river to the frog's lair you must leap on to the logs and turtles' backs, but beware of the diving turtles, the crocodile and the snake.

BCPL (£99.65) is a flexible modern structured language that's very easy to learn. The package consists of a BCPL language ROM, a 40/80 disc and a 450 page User Guide. The disc contains the BCPL Compiler, a Screen Editor and a 6502 Assembler. BCPL is particularly good at handling Input and Output and is ideal for writing utility programs and to develop games and commercial packages.









How to get Acornsoft programs.

If you're a credit card holder and would like to buy the programs shown in this advertisement, or if you would like to know the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy the programs directly by sending off the order form below to:
Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

Also use this form if you would like to receive the current free Acornsoft catalogue.

Please allow 28 days for delivery.

☎ Credit Card Holders. Telephone 01-200 0200.

To: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.
Please send me the following:–

PROGRAM	PRICE	QUANTITY	TOTAL	(Code Acornsoft use only)
Magic Garden	£9.95			SBX04
Draughts & Reversi	£9.95			SBG20
Hopper	£9.95			SBG23
BCPL	£99.65			SNL03
		TOTAL		

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